ORDER NO. HAD8606542C4

Service Manual

Tuner

ST-S75

QUARTZ Synthesizer
AM/FM Stereo Tuner

Color

(K)...Black Type

Color	Areas
(K)	[PA]....Far East PX.
(K)	[PE]....European Military.

SPECIFICATIONS

(IHF '78)

■ FM TUNER SECTION

Frequency range	87.50~108.00MHz
Sensitivity	10.8dBf (0.95µV, IHF '58)
50dB quieting sensitivity	
MONO	18.1dBf (2.2µV/75Ω IHF '58)
STEREO	38.1dBf (22µV/75Ω IHF '58)
Total harmonic distortion	0.15% (MONO), 0.3% (STEREO)
S/N MONO	75dB
STEREO	71dB
Frequency response	20Hz~15kHz, +0.5dB, −1.5dB
Alternate channel selectivity (±400kHz)	65dB
Capture ratio	1.0dB
Image rejection at 98MHz	40dB
IF rejection at 98MHz	70dB
Spurious response rejection at 98MHz	70dB
AM suppression	55dB
Stereo separation	
1kHz	40dB
10kHz	30dB
Carrier leak	
19kHz	−35dB
38kHz	−50dB
Antenna terminals	75 ohms (unbalanced)

■ AM TUNER SECTION

Frequency range	530~1620kHz (10kHz step) 522~1611kHz (9kHz step)
Sensitivity (S/N 20dB)	20µV, 300µV/m
Selectivity (±10kHz)	55dB
Image rejection at 1000kHz	40dB
IF rejection at 1000kHz	60dB

■ GENERAL

Output voltage	0.6V
Power consumption	9W
Power supply	Supply from the amplifier
Dimensions (W×H×D)	430×53×150mm (16-15/16"×2-3/32"×5-7/8")
Weight	1.1kg (2.4lb.)

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Technics

Matsushita Electric Trading Co., Ltd.
P.O. Box 288, Central Osaka Japan

Panasonic Tokyo Office
Matsushita Electric Trading Co., Ltd.
6th Floor, World Trade Center Bldg.,
No. 4-1, Hamamatsu-cho 2-Chome, Minato-ku,
Tokyo 105, Japan

■ LOCATION OF CONTROLS

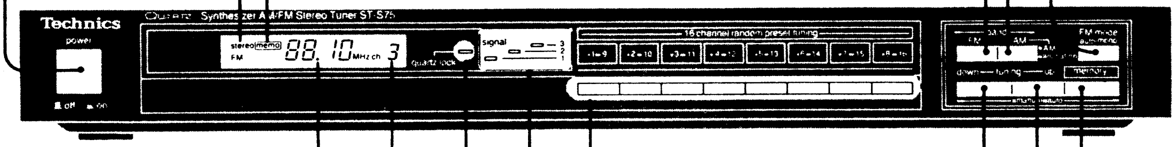
•Power switch (power)

•FM stereo indicator (stereo)
This indicator automatically illuminates when an FM stereo broadcast is being received.
Note:
It will not illuminate if the FM mode selector is pressed.

•FM mode selector (FM mode)
This unit automatically switches to the stereo mode when a stereo broadcast is received. Press this button to listen in the monaural mode. The stereo indicator will not illuminate in the monaural mode.

•Memory indicator (memo)
This indicator illuminates when the memory button is pressed.

•Band selectors (band)
FM:
Press this button to listen to an FM broadcast.
AM:
Press this button to listen to an AM broadcast.
allocation:
When the AM button is pressed for about 4 seconds, the AM frequency step will change to 10 kHz per step.
(This step is set to 9 kHz before shipment.)
In order to return to the original frequency indication, press this button for about 4 seconds again.



•Digital frequency display
The reception frequency of the FM or AM broadcast selected by using the tuning buttons or the preset tuning buttons is indicated by a digital-type display.

•Tuning buttons (tuning)
If the button is pressed momentarily and then released, the frequency will change at intervals of 0.05 MHz for FM and 9 kHz (or 10 kHz) for AM.
If the button is pressed slightly longer and then released, the station will be selected automatically. If the broadcast signals are weak, it may not be possible to make automatic selection. If this occurs, make the selection manually.

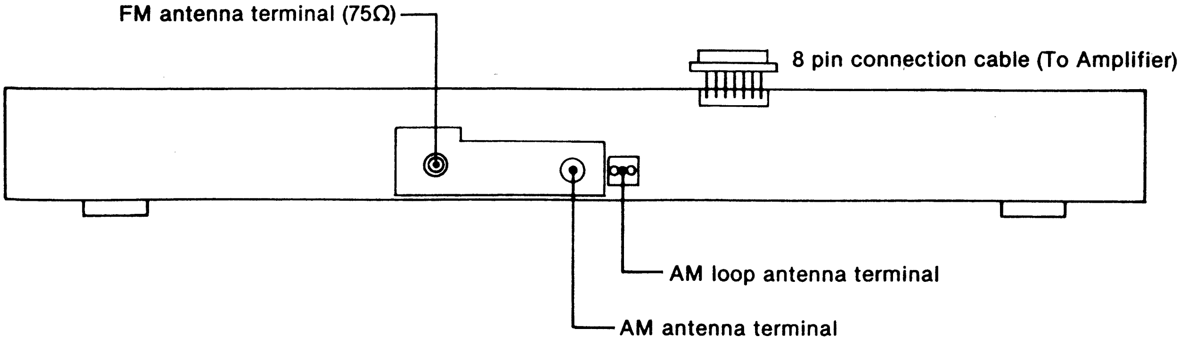
•Memory button (memory)
This button is used when preset memory setting of the preset-tuning buttons is made.

•"Channel" display
The "channel" number selected by the preset-tuning buttons is displayed.

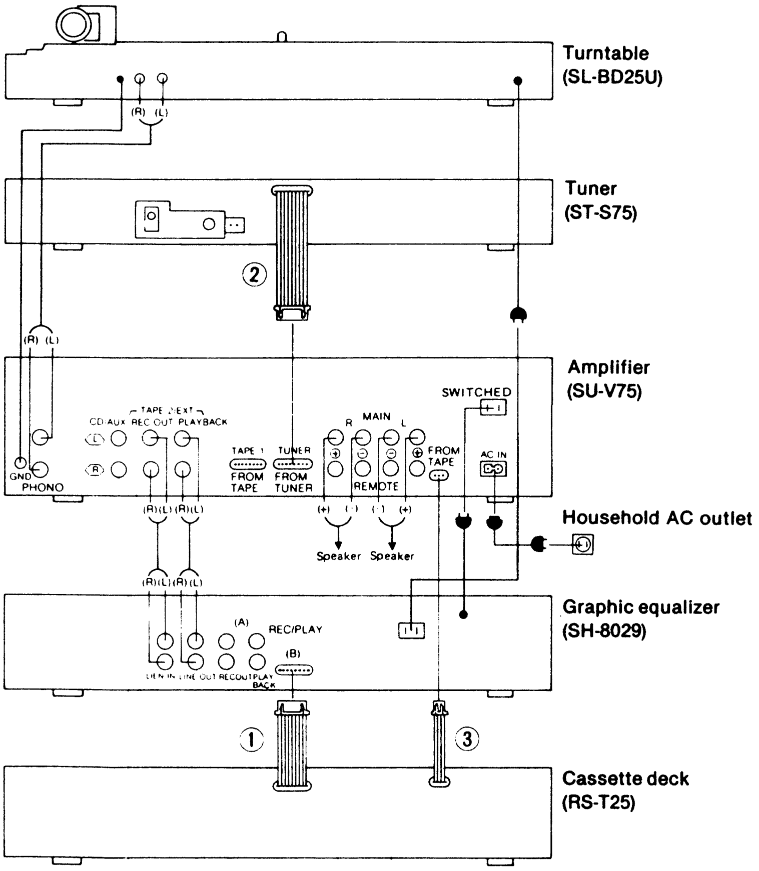
•Preset-tuning buttons (1~16) (16 channel random preset tuning)
These buttons are used to preset FM and AM broadcast frequencies into the memory of this unit, and are also pressed to select the desired preset frequencies.

•Quartz-lock indicator (quartz lock)
This indicator illuminates when tuned precisely to an FM or AM station.

•Signal-strength indicators (signal)
These indicators show the relative strength of broadcast signals being received by the antenna. The best condition for reception, for FM and AM, is when the indicators illuminate completely to the top.


FM antenna terminal (75Ω)
8 pin connection cable (To Amplifier)
AM loop antenna terminal
AM antenna terminal

■ HOW TO CONNECTION


Turntable
(SL-BD25U)
(R) (L)
Tuner
(ST-S75)
②
(R) (L)
Amplifier
(SU-V75)
SWITCHED
TAPE EXT
CD AUX REC OUT PLAYBACK
MAIN
R L
GND
PHONO
TAPE 1
TUNER
FROM TAPE
FROM TUNER
REMOTE
FROM TAPE
AC IN
(R)(L)(R)(L)
(+) (-) (-) (+)
Speaker Speaker
Household AC outlet
(R)(L)(R)(L)
(A)
REC/PLAY
(B)
Graphic equalizer
(SH-8029)
①
③
Cassette deck
(RS-T25)

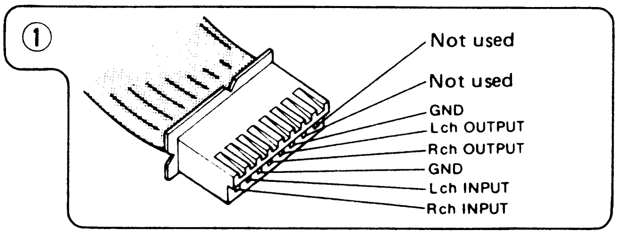
Notes:

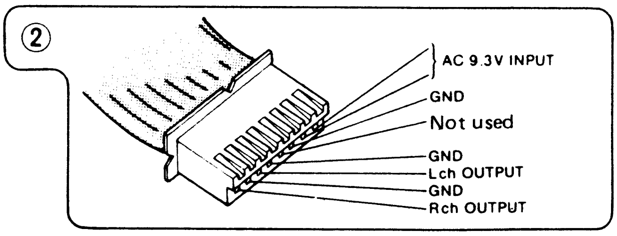
- When a tape deck is connected to the (A) or (B) terminals of the graphic equalizer, recordings from the graphic equalizer can be made.
- Connections cannot be made to both the (A) and the (B) terminals at the same time.

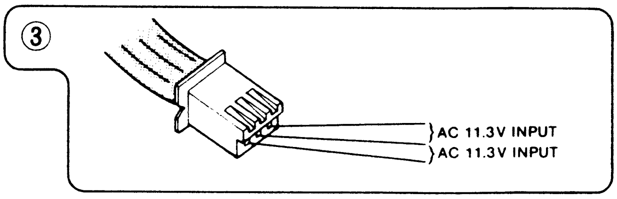
Connect the turntable, tuner, amplifier, graphic euqalizer and cassette deck as shown.

If the connection is wrong, normal operation will not be attained.

* Tuner (ST-S75) and Cassette deck (RS-T25) are not equipped with power supply. The amplifier shown or power supply fixture (SZZA1065C) is necessary for the repair and check of Tuner or Cassette deck.

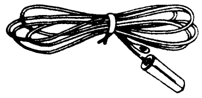

①
Not used
Not used
GND
Lch OUTPUT
Rch OUTPUT
GND
Lch INPUT
Rch INPUT


②
AC 9.3V INPUT
GND
Not used
GND
Lch OUTPUT
GND
Rch OUTPUT

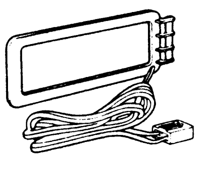

③
AC 11.3V INPUT
AC 11.3V INPUT

■ ACCESSORIES

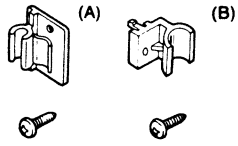
- FM indoor antenna 1



- AM loop antenna 1



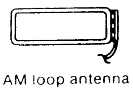
- AM antenna holders 2



■ MEMORY PRESETTINGS

With this unit you may preset as many as 16 radio broadcast stations: FM/AM random presetting. After broadcast stations have been preset as described below., any desired station can be quickly and easily selected by simply touching one button.

Important!



If this antenna is not installed, AM broadcasts will not be received.

Note:
If a new broadcasting station is preset into a channel, the broadcasting station which was previously entered in that channel will be automatically erased.

Automatic memory presetting

The FM broadcasting stations and AM broadcasting stations will be automatically preset to "channels" 1 through 16 for FM and 9 through 16 for AM, respectively.

Note: When AM is automatically preset, the FM stations on "channels" 9 through 16 will be replaced by the new AM stations.

1 Power: "on" (▪→ ▪)

2 "FM": for FM broadcasts
"AM": for AM broadcasts

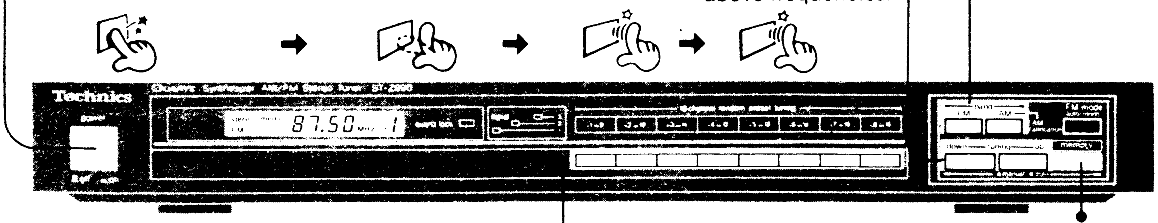
Before presetting the broadcasting stations, press to select the appropriate frequency step for your locality.

3 Set to the lowest frequency.
- **FM: 87.50 MHz**
- **AM: 522 kHz** (9 kHz step) **or 530 kHz** (10 kHz step)

① Press the button and hold slightly (frequency will change continuously).

② Release it when approaching the above exact frequency, and then press the button again momentarily (frequency change will stop).

③ Press the button momentarily (frequency will change each time the button is pressed), and tune to one of the above frequencies.



4 Press. When the frequency indication begins to change, release.

The frequency will change upward, and the automatic presetting will begin with the next broadcasting station.
It will continue to preset consecutive broadcast stations.

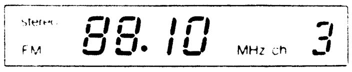
Notes:
1. For automatic presetting in areas where there are less than 16 FM stations, the remaining channels (through channel 16) will be left empty. The empty channels can be filled by using manual memory presetting.
2. For AM broadcasts with extremely strong signal transmissions, the frequency memorized may be slightly different from the correct frequency. If this occurs, use the manual control to memorize.

5 Confirm the names (call signs, etc.) of the broadcasting stations which are preset to each channel, and enter them on the file sheet.

To check the front channels (CH 1~ 8):

Press momentarily.

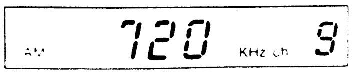
Frequency stored in the memory and channel number are displayed.



To check the back channels (CH 9~ 16):

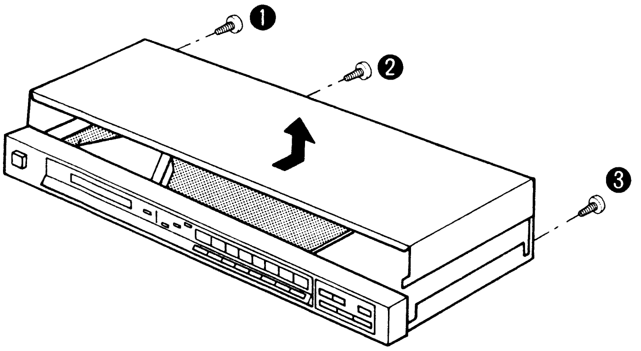
Press slightly longer.

Frequency stored in the memory and channel number are displayed.

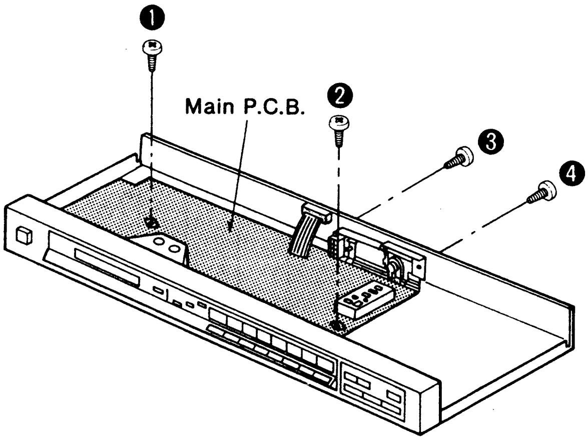


■ DISASSEMBLY INSTRUCTIONS

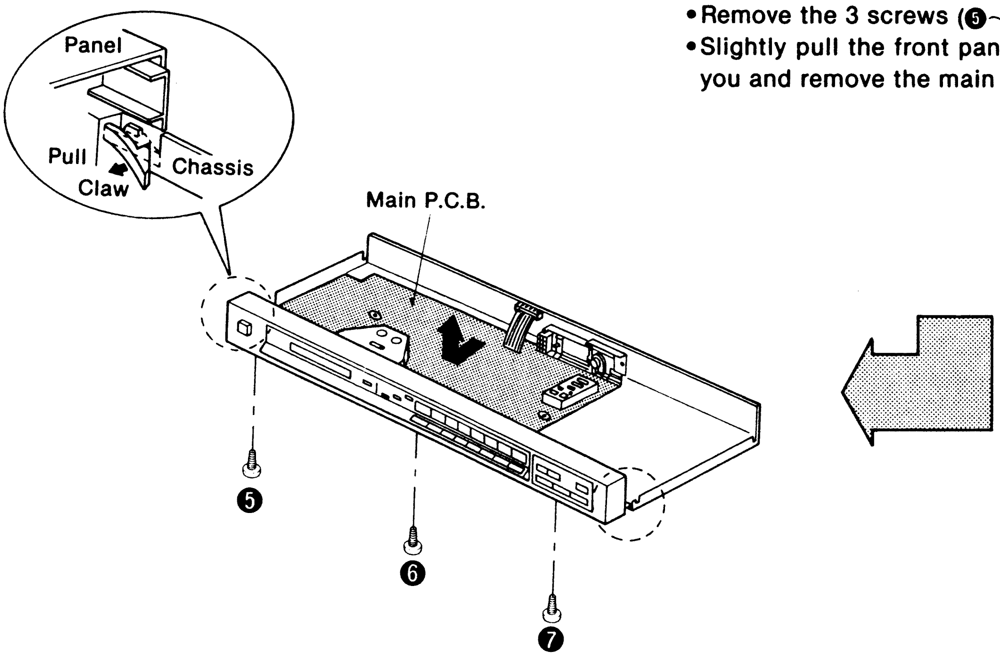
Ref. No. 1	How to remove the cabinet
Procedure 1	• Remove the 3 screws (❶~❸).



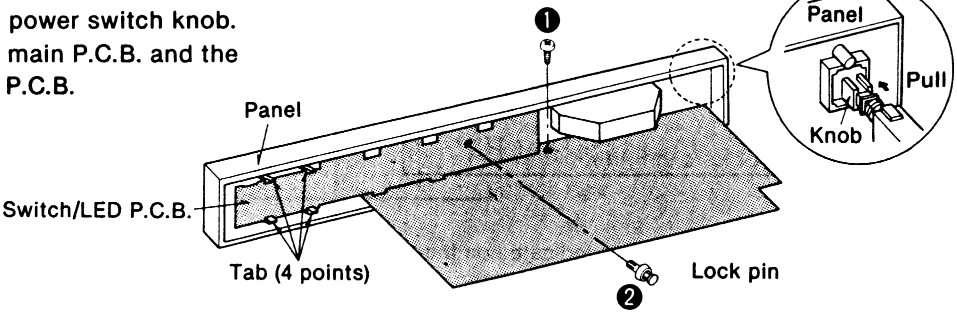
Ref. No. 2	How to remove the main P.C.B.
Procedure 1 → 2	• Remove the 4 screws (❶~❹).


❶
Main P.C.B.
❷
❸
❹

- Remove the 3 screws (❺~❼).
- Slightly pull the front panel toward you and remove the main P.C.B.

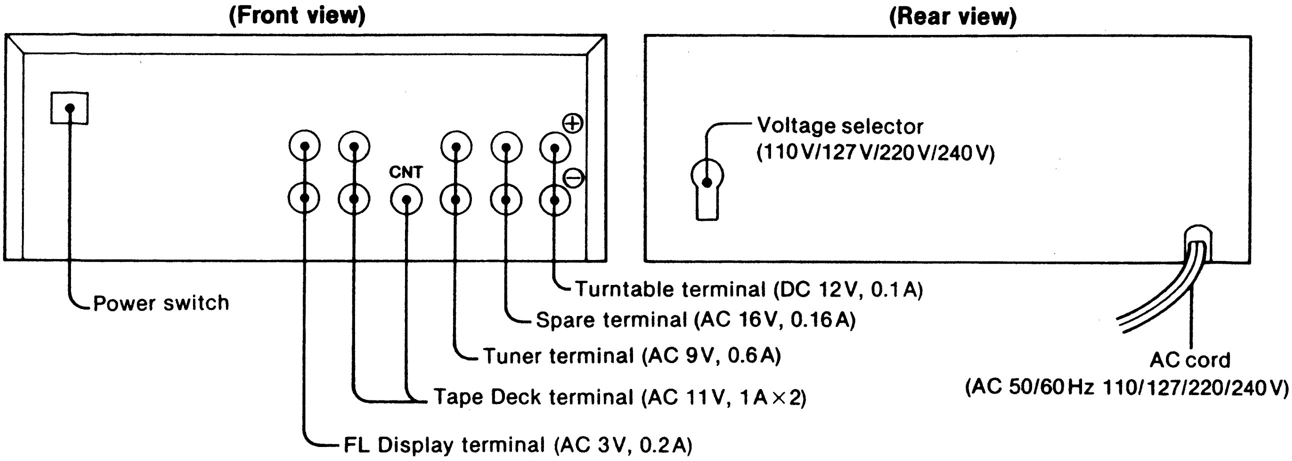

Panel
Pull
Claw
Chassis
Main P.C.B.
❺
❻
❼

Ref. No. 3	How to remove the front panel
Procedure 1 → 2 → 3	• Remove the 1 screw (❶). • Remove the 1 lock pin (❷). • Remove the 4 tabs. • Remove the power switch knob. • Remove the main P.C.B. and the switch/LED P.C.B.

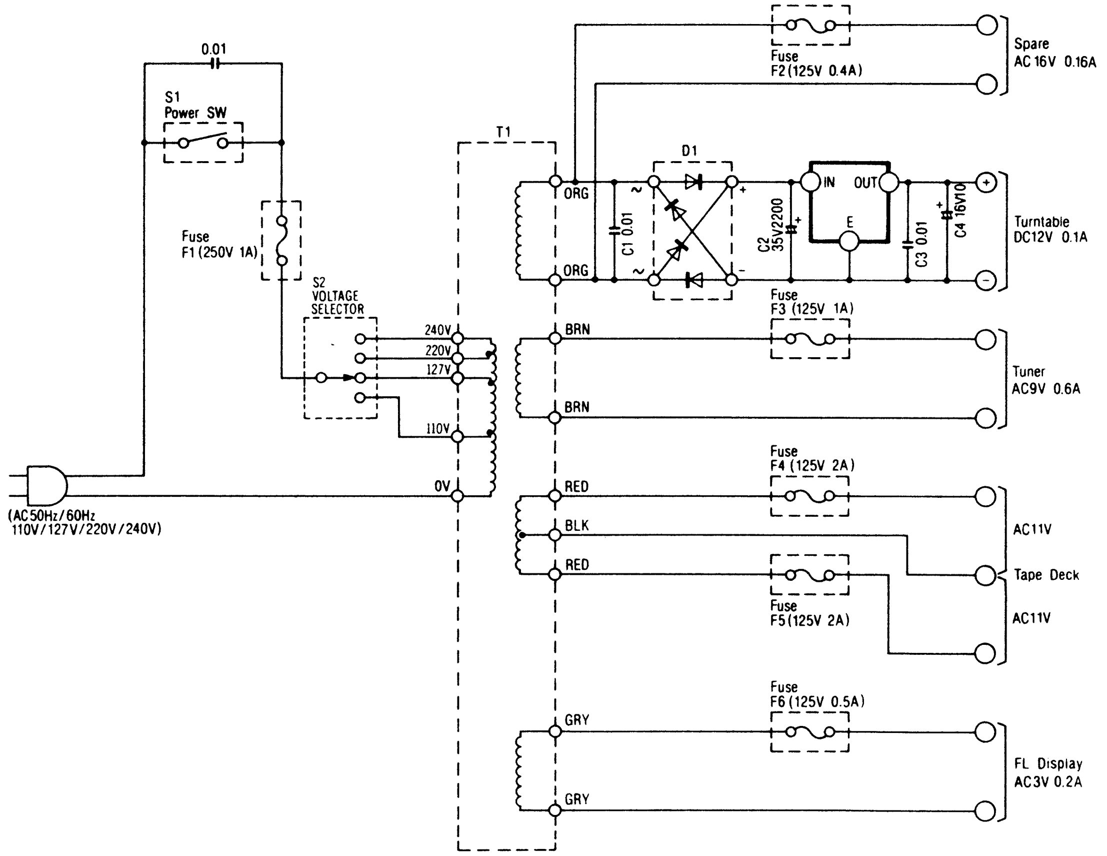

❶
Panel
Pull
Knob
Panel
Switch/LED P.C.B.
Tab (4 points)
Lock pin
❷

■ INFORMATION ON POWER SUPPLY FIXTURE (SZZA1065C)

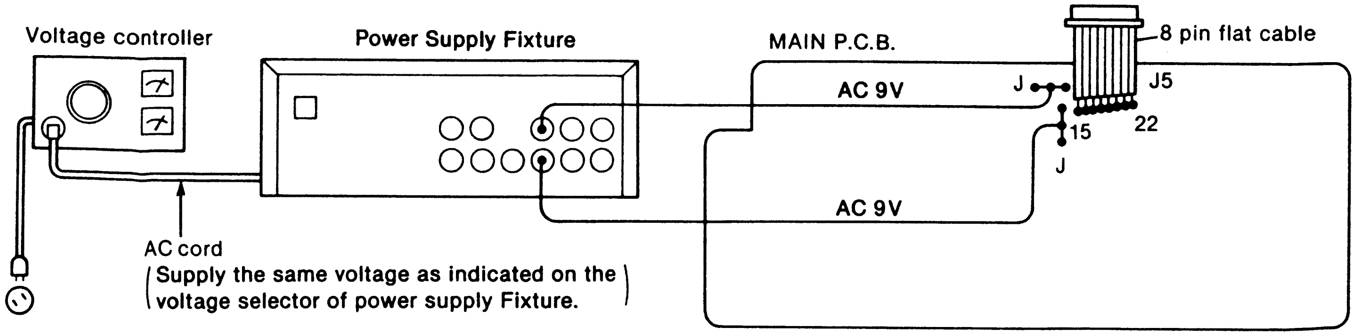
• LOCATION


(Front view)
(Rear view)
CNT
⊕
⊖
Voltage selector
(110V/127V/220V/240V)
Power switch
Turntable terminal (DC 12V, 0.1A)
Spare terminal (AC 16V, 0.16A)
Tuner terminal (AC 9V, 0.6A)
Tape Deck terminal (AC 11V, 1A×2)
FL Display terminal (AC 3V, 0.2A)
AC cord
(AC 50/60Hz 110/127/220/240V)

• SCHEMATIC DIAGRAM (Reference)


0.01
S1
Power SW
Fuse
F1 (250V 1A)
S2
VOLTAGE
SELECTOR
240V
220V
127V
110V
0V
(AC50Hz/60Hz
110V/127V/220V/240V)
T1
ORG
ORG
BRN
BRN
RED
BLK
RED
GRY
GRY
Fuse
F2 (125V 0.4A)
Spare
AC16V 0.16A
D1
C1 0.01
C2
35V2200
IN
OUT
E
C3 0.01
C4 16V10
Turntable
DC12V 0.1A
Fuse
F3 (125V 1A)
Tuner
AC9V 0.6A
Fuse
F4 (125V 2A)
AC11V
Tape Deck
Fuse
F5 (125V 2A)
AC11V
Fuse
F6 (125V 0.5A)
FL Display
AC3V 0.2A

• HOW TO CONNECT


Voltage controller
Power Supply Fixture
MAIN P.C.B.
8 pin flat cable
AC 9V
J
J5
15
22
J
AC 9V
AC cord

(Supply the same voltage as indicated on the voltage selector of power supply Fixture.)

■ MEASUREMENTS AND ADJUSTMENTS

■ AM/FM

Control positions and equipment used

- AM and FM signal generator (AM and FM-SG)
- Stereo modulator
- Distortion analyser
- Oscilloscope
- AC and DC electronic voltmeter (EVM)
- Frequency counter
- Choke coil (100µH)
- Resistor (100kΩ)
- Ceramic capacitor (200pF)

Note: For **T201** (AM-IFT) and **L204** (AM OSC coil), adjusted parts are supplied.
So, do not turn the cores of this parts.

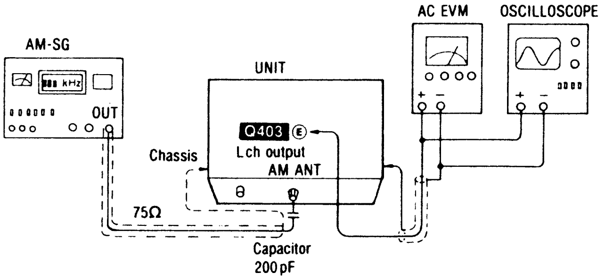
AM ADJUSTMENT

1. Test equipment connection is shown in figure.
2. Set the unit to "**AM**" position.
3. Place the radio dial and signal generator setting to **612kHz.**
4. Adjust **L205** for maximum output.
5. Place the radio dial and signal generator setting to **1503kHz.**
6. Adjust **CT202** for maximum output.
7. Repeat steps 3.~6.

Note:

Antenna input level must be as low as possible being free from AGC.

AM SIGNAL GENERATOR CONDITION
Modulation 30%
Modulation frequency.......400Hz


AC EVM
OSCILLOSCOPE
AM-SG
kHz
OUT
UNIT
Q403
E
Chassis
Lch output
AM ANT
75Ω
Capacitor
200pF

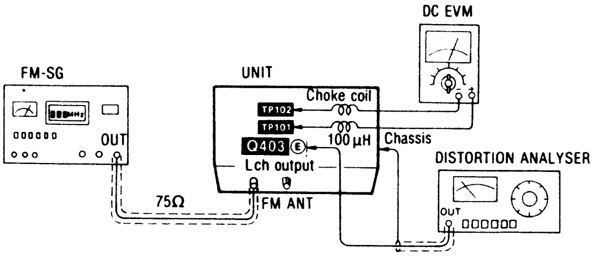
FM MONO DISTORTION ADJUSTMENT

1. Test equipment connection is shown in figure.
2. Set the unit to "**FM**" position.
3. Place the radio frequency display and signal generator setting to **100.10MHz.**
4. Adjust **T101** core so that voltage measured in signal mode is **0mV (0±50mV)** in 1V range.
5. Adjust **T102** so that the distortion factor of Lch is minimized.
6. Repeat steps 4 and 5 a few times.
7. Make sure that the distortion factors of Lch and Rch are at minimum and nearly equal.

Note:

The adjusting screwdriver used should be made of resin.

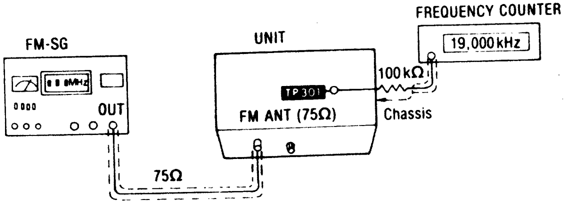
FM SIGNAL GENERATOR CONDITION
Modulation 100%
Modulation frequency.......400Hz
Output level.......................66dB


DC EVM
FM-SG
MHz
OUT
UNIT
Choke coil
TP102
TP101
100µH
Chassis
Q403
E
Lch output
75Ω
FM ANT
DISTORTION ANALYSER
OUT

MPX VCO ADJUSTMENT

1. Test equipment connection is shown in figure.
2. Set the unit to "**FM/auto**" position.
3. Place the radio dial and signal genarator setting to **100 MHz**.
4. Adjust **VR302** for **19 kHz±50 Hz** on frequency counter reading.

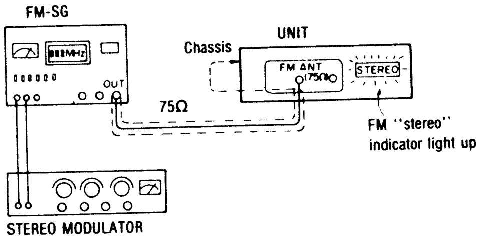
FM SIGNAL GENERATOR CONDITION
Modulation 0
Modulation frequency.......0
Output level........................66 dB


FREQUENCY COUNTER
19.000 kHz
FM-SG
UNIT
OUT
TP301
100 kΩ
Chassis
FM ANT (75Ω)
75Ω

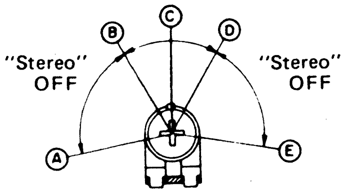
★ USING ALTERNATE SYSTEM

1. Apply stereo signal from generator or receive the stereo boardcast.
2. Adjust **VR302** until stereo indicator lights up. Cement arm of **VR302** as shown in figure.

FM SIGNAL GENERATOR CONDITION
Modulation 10%
Modulation frequency.......Pilot (19 kHz)
Output level........................66 dB


FM-SG
OUT
Chassis
UNIT
FM ANT (75Ω)
STEREO
75Ω
FM "stereo" indicator light up
STEREO MODULATOR

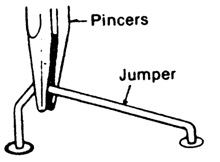
Pilot signal to ON ....19 kHz
Output mode ....L+R


Ⓑ
Ⓒ
Ⓓ
"Stereo" OFF
"Stereo" OFF
Ⓐ
Ⓔ

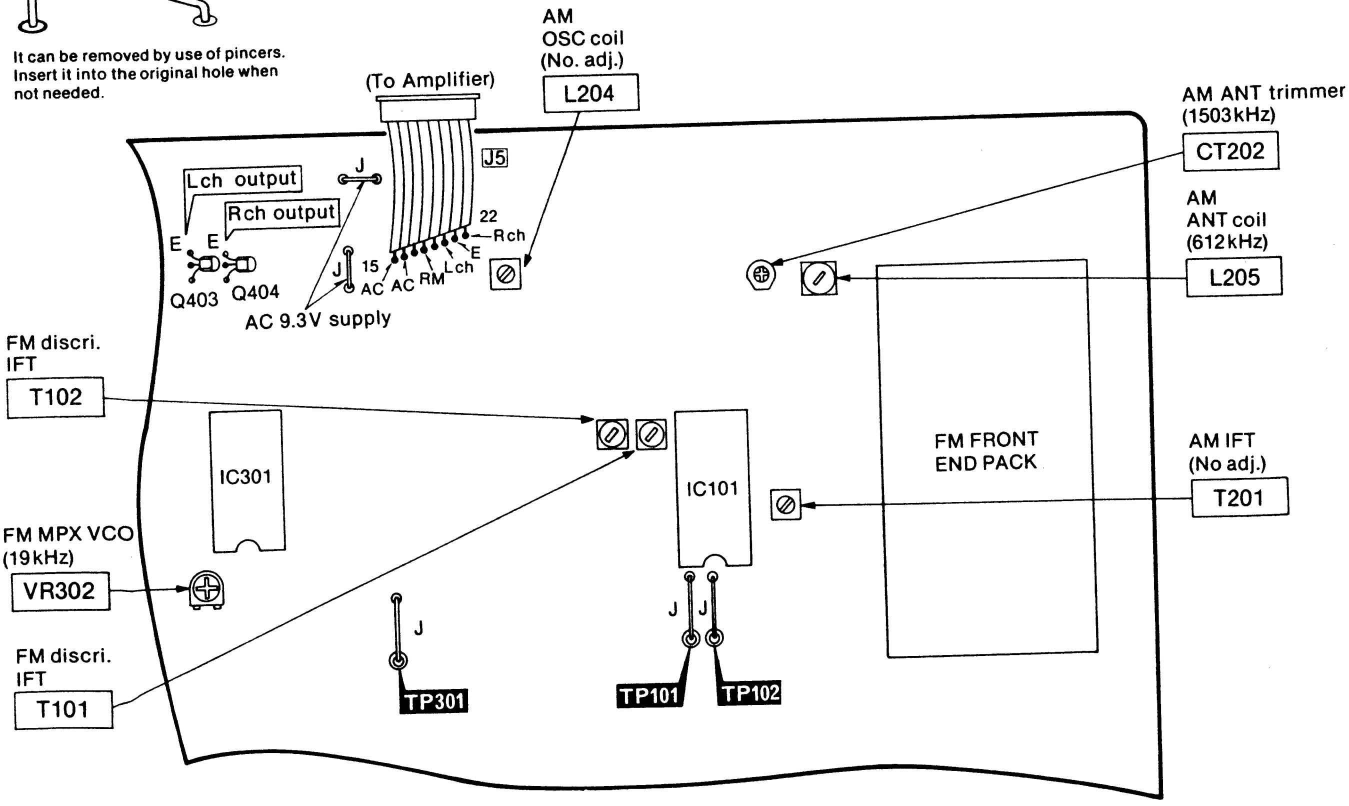
VR302

Ⓐ–Ⓑ,
Ⓓ–Ⓔ........"Stereo" OFF position
Ⓑ–Ⓓ........"Stereo" ON position (Indicator lighting)
Ⓒ...............Adjust point of pilot circuit

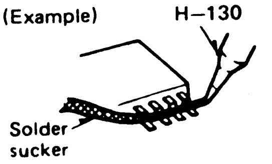
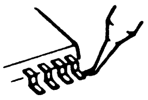
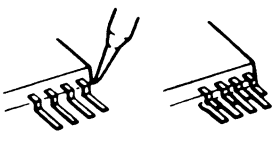
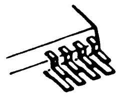
• Adjustment points


Pincers
Jumper

It can be removed by use of pincers. Insert it into the original hole when not needed.


AM OSC coil (No. adj.)
L204
(To Amplifier)
AM ANT trimmer (1503 kHz)
CT202
J5
Lch output
Rch output
J
22
Rch
E
E
E
Lch
15
AC
AC
RM
J
Q403
Q404
AC 9.3V supply
AM ANT coil (612 kHz)
L205
FM discri. IFT
T102
IC301
IC101
FM FRONT END PACK
AM IFT (No adj.)
T201
FM MPX VCO (19 kHz)
VR302
J
J
J
FM discri. IFT
T101
TP301
TP101
TP102

■ HOW TO REPLACE IC'S (Small outline type)

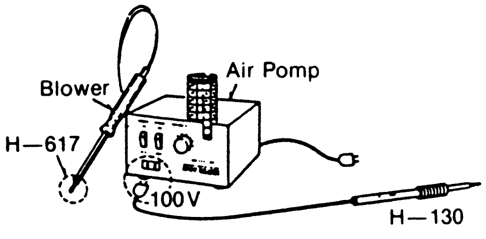
Replacing procedure			Cautions
1	Reduce the amount of solder on each pin of the integrated circuit by use of a solder sucker.		• Recommended tool ....Special soldering iron * H605M and H-130. * H605E and H-130. • Do not touch the soldering iron to the area for a long time. It may otherwise cause removal of the print foil. • When shifting the pin upward, do the job quickly while the solder is melting. If the solder is hard, it may cause removal or breakage of the print foil. • When using a pencil type soldering iron. 1. Completely remove the solder from each IC pin by use of solder sucker. 2. Raise each pin by means of an eyeleteer, hold the pliers then remove IC package from P.C.B.
2	Melt the solder on the pin (one electrode) with the soldering iron.		
3	While the solder is melting, shift the pin upward by the soldering iron to remove it from the foil.		
4	Remove each pin from the foil according to the above-mentioned procedure.		

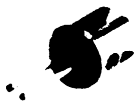
*** Special soldering iron**
(Refer to Technical Information, ORDER NO. GAD84125486T1)...For U.S.A. and Canada
(Refer to Technical Information, ORDER NO. GAD84115476T8)...For others

•H−605 Spot Heater (hot-air solder iron)

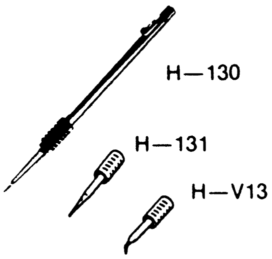
This device that uses hot air to melt solder was developed to remove Flat-Pakage ICs, RHCs and chip parts.

- •H−605M (For 120V power source)
- •H−605E (For 200V/220V/240V power source)





H—617



•H−617 Twin Nozzle (for spot heater)

Special nozzle for the removal of RHCs and chip resistors. (Nozzle diameter: 1.0mm×2)

•H−130 Slim Pencil Solder Iron

An ultrasmall ceramic heater solder iron is extremely handy for soldering chip parts, RHCs, ICs etc., to high-density circuit boards.

Features:

•Rated power:	100V, 15W
•Max. temp.:	400°C
•Heater:	ceramic (long life)
•Insulation resistance:	100MΩ
•Length:	178mm
•Weight:	16g (not including cord)

•H−131, H−V13 Cap Bits

Solder tip for the slim pencil Solder Iron and is composed of a bit holder and a corrosion resistance solder tip.

Permits changing of solder tips even while still hot.

•Solder tip: 0.3mm

■ FUNCTION OF TERMINAL (PLL controller IC901: UPD1718G514)

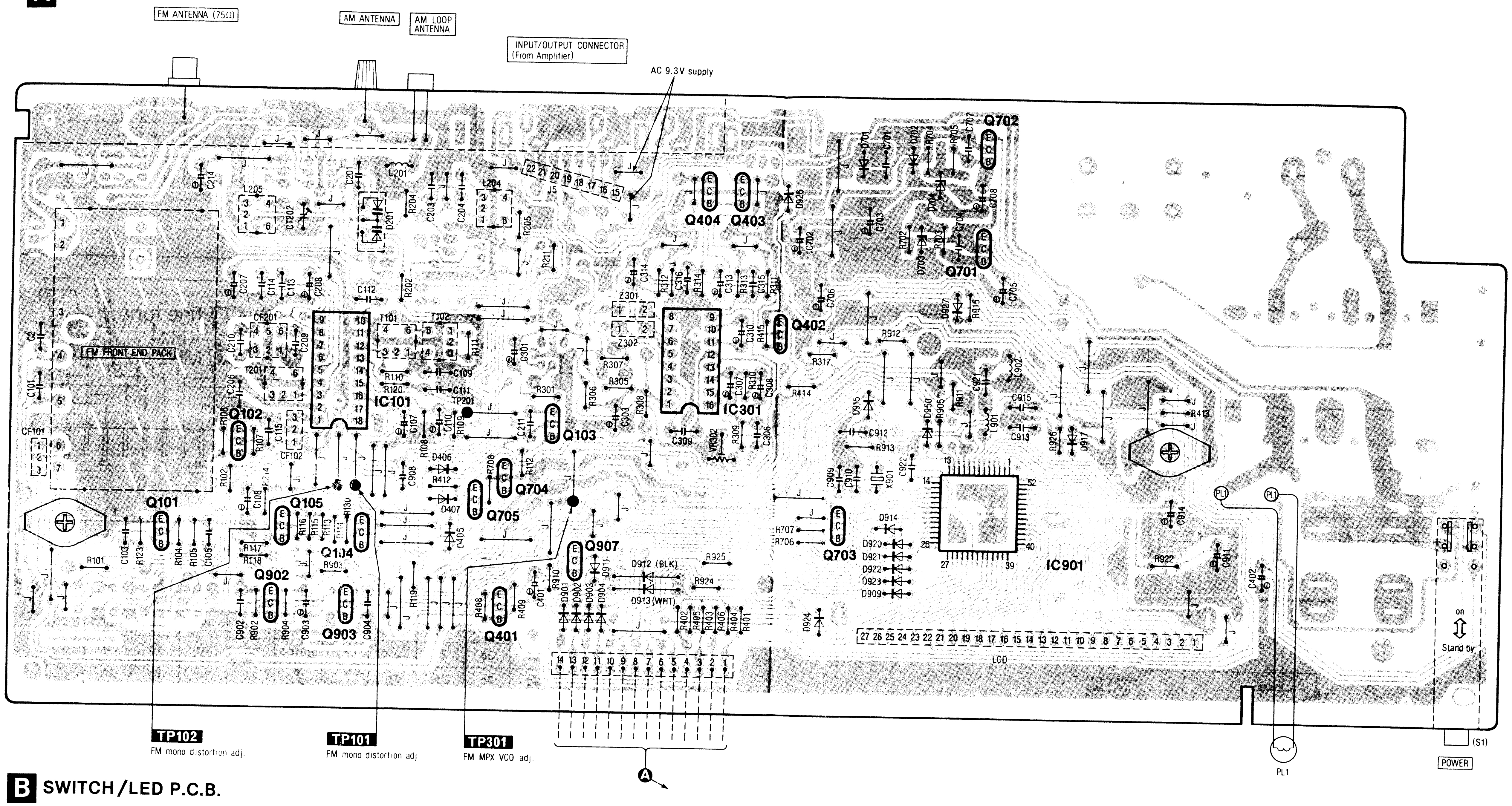
PIN NO.	IN/OUT	MARK	DESCRIPTION OF TERMINAL
1 ~ 4 34 ~ 52	OUTPUT	LCD4 ~ LCD1 LCD23 ~ LCD5	Segment signal output terminal for display.
5	OUTPUT	COM2	Common signal output terminal connected to LCD. Output is delivered in 3 values of ground, 1/2V_{DD} and V_{DD} (at 5 ms intervals) in a period of 50 Hz. The segment turns ON when the difference in voltage is ± V_{DD} between these terminals and LCD1~LCD23.
6		COM1	
7	INPUT	V_{DD}	Power supply terminal of device. Voltage of 5 V ± 10% is supplied during operation of device. To hold the internal date memory (RAM), the voltage can be decreased to 2.5 V. **Note:** Pins 7 and 33 are connected inside the chip. It is unnecessary to supply voltage to the pins.
33		V_{DD}	
8	INPUT	FM	Input is local oscillator output (VCO) in a range of 10~130 MHz (0.3 Vp-p, min.). There are 1/2 fixed frequency division prescaler and 2-step (1/32, 1/33) prescaler internally. Therefore, when deciding the frequency dividing value of programmable divider, it must be decided from the frequency obtained by halving the local oscillator output (VCO).
9	INPUT	AM	Input is local oscillator output (VCO) in a range of 0.5~20 MHz (0.1 Vp-p, min.). When the mode is shifted to FM, the AM terminal voltage automatically becomes the supply voltage of device.
10	———	GND	Ground terminal.
11	———	E01	Not used in this unit.
12	OUTPUT	E02	When the divided oscillator frequency is higher than the standard frequency, H-level output is delivered from these terminals. When it is lower, L-level (0 V) output is delivered. When they coincide, it results in floating.
13	INPUT	CE	Device selection signal input terminal. The signal level should be high when the device is operated, and low when not operated. With this terminal shifted to low level, LCD (liquid crystal display) turns off and the memory is held.
14	———	NC	Not used in this unit.
15	OUTPUT	X1	Connecting terminal for crystal oscillator. The crystal connected is 4.5 MHz.
16	INPUT	X2	
17	INPUT	SD	Terminal to put in stop signal during auto tuning. The voltage is 5 V with broadcast received, and 0 V without broadcast received.
18	INPUT	REMOTE CONTROL	This is the interrupt demand signal input terminal. The signal from the control input terminal is put into this terminal, demanding for interruption, then the flow of program will be unconditionally shifted to the address No. 1.
19	OUTPUT	FM	FM/AM output terminal. (FM → 5 V, AM → 0 V)
20	OUTPUT	FM MONO	Auto/mono changeover output terminal. (auto → 0 V, mono → 5 V)
21 ~ 24	INPUT	KEY3 ~ KEY0	Input terminal for key return signal from external key matrix.
25 ~ 28	OUTPUT	PB3 ~ PB0	Output terminal for key return signal to external key matrix.
29	OUTPUT	PC3	Terminal for FM IF ceramic filter frequency compensation. A pulse is generated when the voltage of terminal 13 rises.
30	OUTPUT	PC2	Output terminal for key return signal to let the stereo indicator light up.
31	OUTPUT	PC1	Not used in this unit.
32	OUTPUT	MUTE	Muting signal output terminal. Muting signal is delivered during operation of FM/AM selector switch and tuning switch. (4 V during muting)

[KEY MATRIX]

Pin No.	25	26	27	28	29
21	UP	AM	CH5/13	CH1/9	—
22	DOWN	—	CH6/14	CH2/10	—
23	—	FM	CH7/15	CH3/11	MEMORY
24	—	FM MODE	CH8/16	CH4/12	—

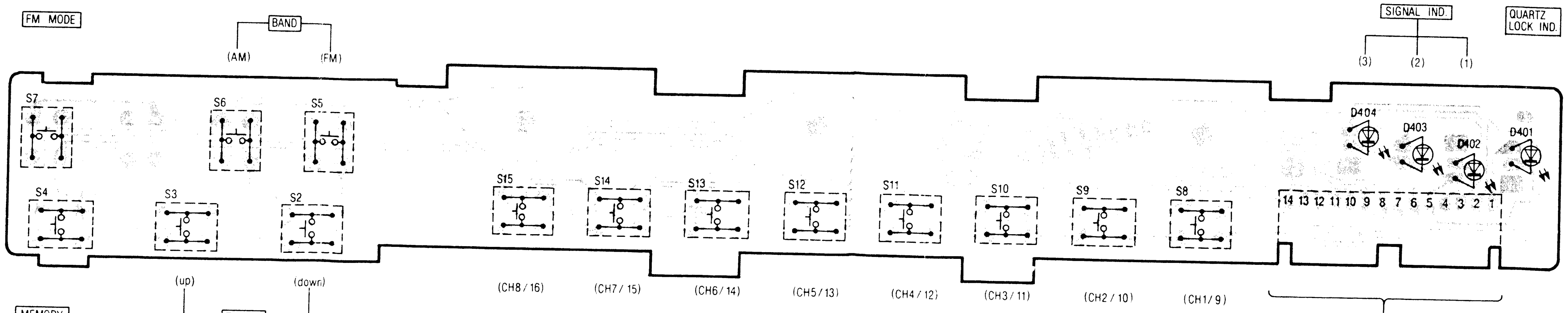
■ CIRCUIT BOARDS AND WIRING CONNECTION DIAGRAM

A MAIN P.C.B.



1
2
3
4
5
6
7
8
9
A
B
C
D
E
FM ANTENNA (75Ω)
AM ANTENNA
AM LOOP ANTENNA
INPUT/OUTPUT CONNECTOR (From Amplifier)
AC 9.3V supply
J5
FM FRONT END PACK
CF101
CF102
CF201
T101
T102
T201
L201
L204
L205
Z301
Z302
IC101
IC301
IC901
TP201
Q101
Q102
Q103
Q104
Q105
Q401
Q402
Q403
Q404
Q701
Q702
Q703
Q704
Q705
Q902
Q903
Q907
VR302
X901
D912 (BLK)
D913 (WHT)
PL1
on
Stand by
LCD
TP102
FM mono distortion adj.
TP101
FM mono distortion adj.
TP301
FM MPX VCO adj.
(S1)
POWER
PL1
A

B SWITCH/LED P.C.B.



F
G
FM MODE
BAND
(AM)
(FM)
SIGNAL IND.
(3)
(2)
(1)
QUARTZ LOCK IND.
S7
S6
S5
S4
S3
S2
S15
S14
S13
S12
S11
S10
S9
S8
D404
D403
D402
D401
14 13 12 11 10 9 8 7 6 5 4 3 2 1
MEMORY
(up)
(down)
TUNING
(CH8/16)
(CH7/15)
(CH6/14)
(CH5/13)
(CH4/12)
(CH3/11)
(CH2/10)
(CH1/9)
A

■ RESIS

Notes: • Part
Pleas

Numbering S

Example

ERD	25
Type	Wattage S

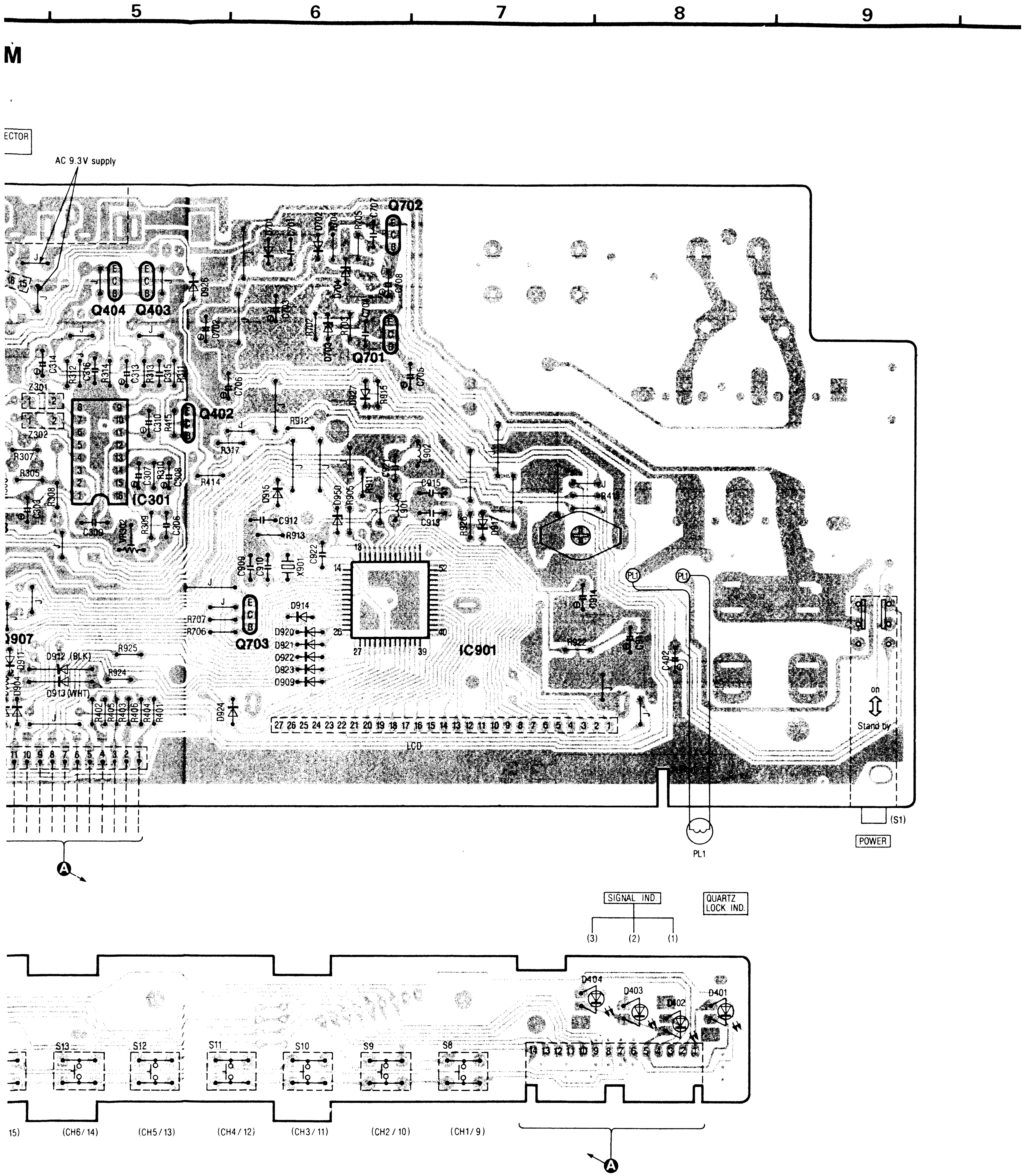
Resistor Type
ERD : Carbon
ERC : Solid
ERO : Metal F

● RESISTORS

Ref. No.	Par
R101	ERDS2T
R102	ERDS2T
R104	ERDS2T
R105	ERDS2T
R106	ERDS2T
R107	ERDS2T
R108	ERDS2T
R109	ERDS2T
R110	ERDS2T
R111	ERDS2T
R112	ERDS2T
R113, 114	ERDS2TJ
R115	ERDS2TJ
R116	ERDS2TJ
R117	ERDS2T
R118	ERDS2TJ
R119	ERDS2TJ

● CAPACITORS

Ref. No.	Part N
C2	ECKD1H1
C101	ECKD1H1
C103	ECKD1H1
C105	ECCD1H3
C107	ECEA1HU
C108	ECEA1CU
C109	ECKD1H1
C110	ECEA1CU
C111	ECCD1H1
C112, 113	ECKD1H2
C114	ECKD1H2
C115	ECCD1H1
C201	ECQM1H4
C203	ECCD1H1



■ RESISTORS AND CAPACITORS

Notes:
- Part numbers are indicated on most mechanical parts. Please use this part number for parts order.
- The unit of resistance is OHM (Ω). K=1000Ω, M=1000kΩ
- The unit of capacitance is MICROFARAD (μF). P=10^{-6}μF.

Numbering System of Resistor

Example

ERD	25	F	J	101
Type	Wattage	Shape	Tolerance	Value

Resistor Type	Wattage	Tolerance
ERD : Carbon	25 : 1/4W	F : ±1%
ERC : Solid	S2 : 1/4W	J : ±5%
ERO : Metal Film	S1 : 1/2W	K : ±1%
	12 : 1/2W	

Numbering System of Capacitor

Example

ECKD	1H	102	Z	F
Type	Voltage	Value	Tolerance	Peculiarity

ECEA	50	M	R47	R
Type	Voltage	Peculiarity use	Value	Special use

Capacitor Type	Voltage		Tolerance
	ECEA Type	Other	
ECEA : Electrolytic	0J : 6.3V	1H : 50V DC	C : ±0.25pF
ECCD : Ceramic	1A : 10V	1 : 125V DC	G : ±2%
ECKD : Ceramic	1C : 16V	KC : 400V AC	J : ±5%
ECQM : Polyester	1E : 25V		K : ±10%
ECQP : Polypropylene	1H : 50V		Z : +80%, −20%
	1V : 35V		
	25 : 25V		

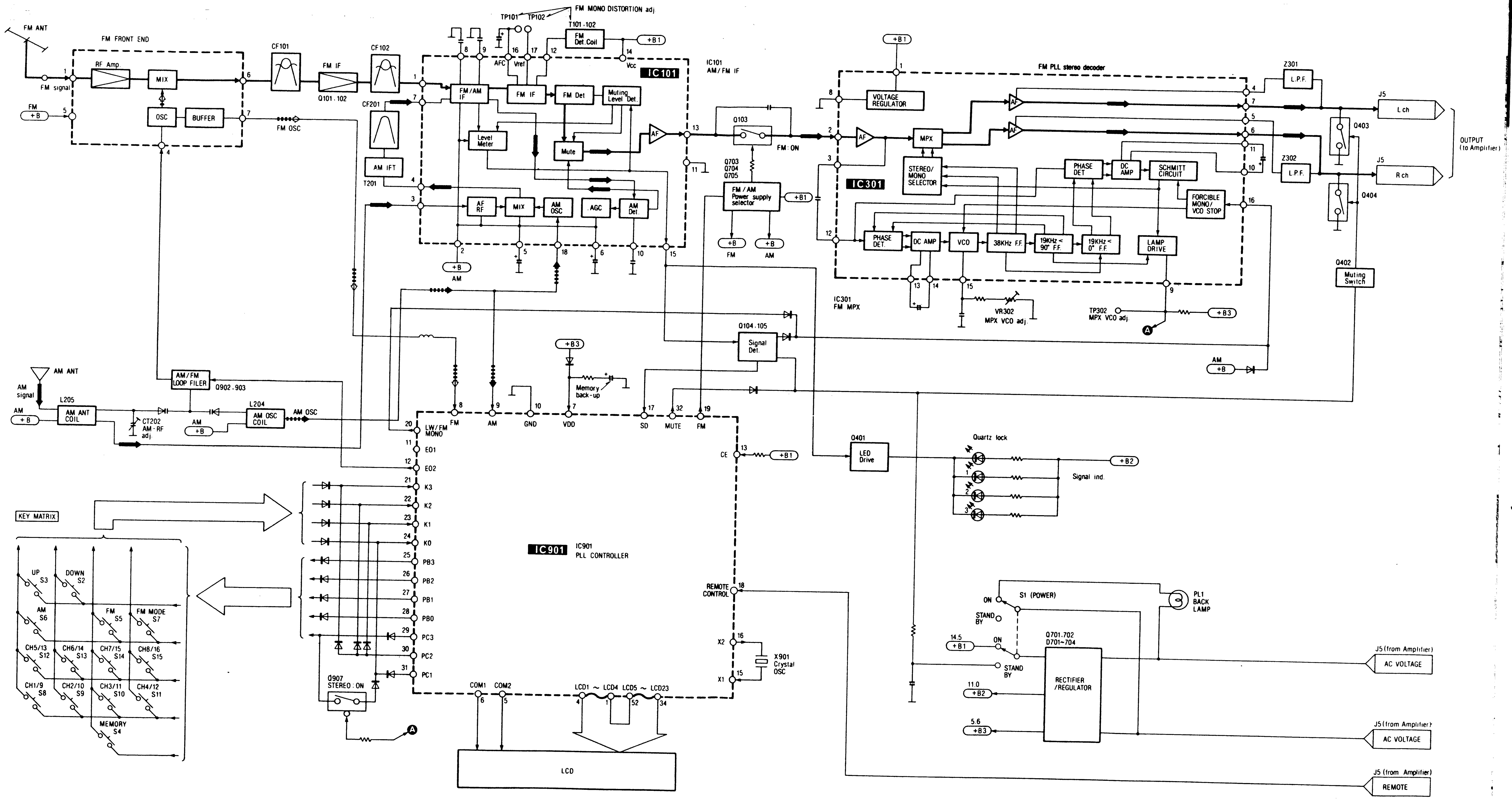
● RESISTORS

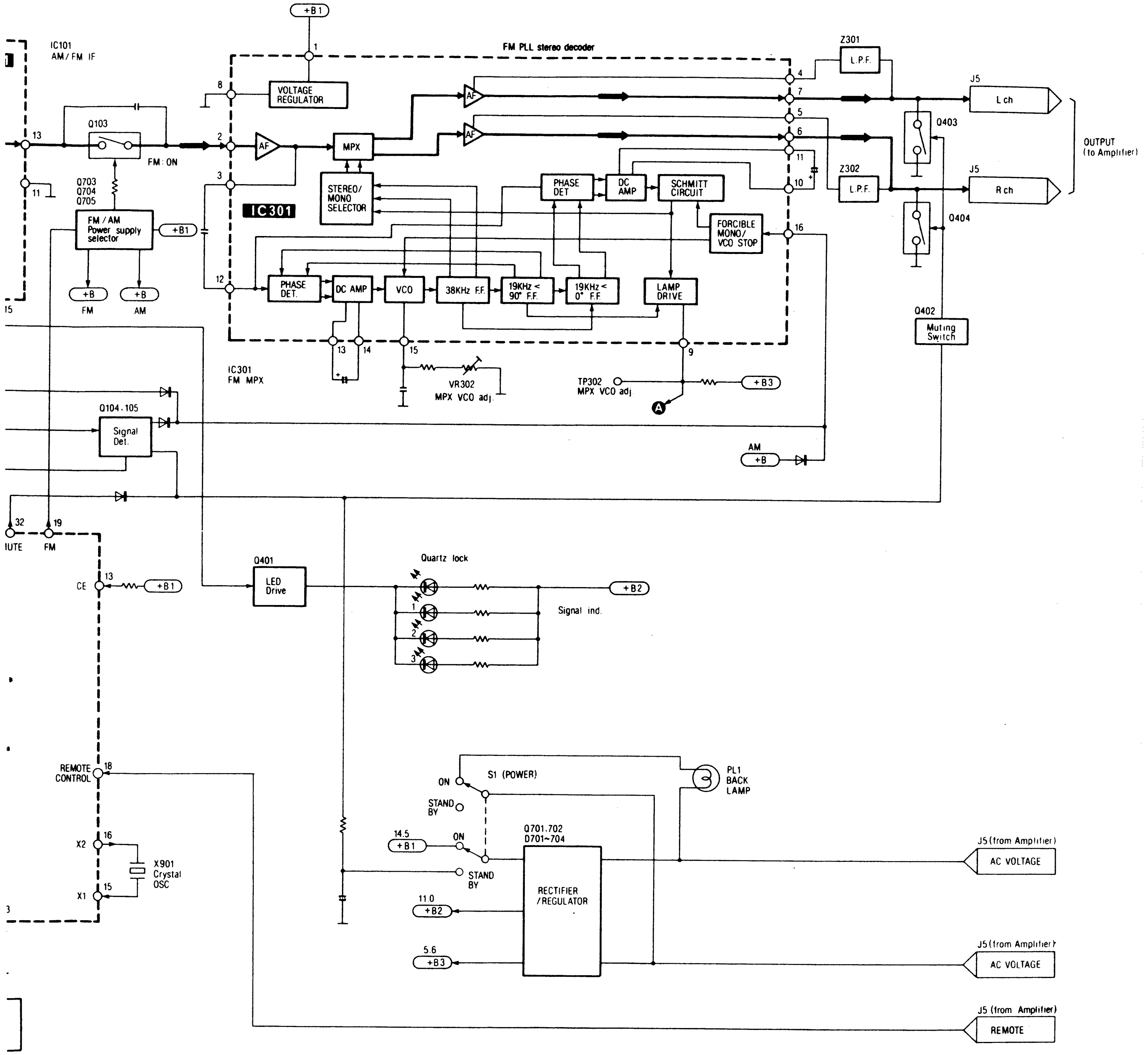
Ref. No.	Part No.	Value
R101	ERDS2TJ151	150
R102	ERDS2TJ122	1.2K
R104	ERDS2TJ474	470K
R105	ERDS2TJ122	1.2K
R106	ERDS2TJ824	820K
R107	ERDS2TJ271	270
R108	ERDS2TJ102	1K
R109	ERDS2TJ471	470
R110	ERDS2TJ822	8.2K
R111	ERDS2TJ222	2.2K
R112	ERDS2TJ104	100K
R113, 114	ERDS2TJ223	22K
R115	ERDS2TJ563	56K
R116	ERDS2TJ471	470
R117	ERDS2TJ104	100K
R118	ERDS2TJ153	15K
R119	ERDS2TJ822	8.2K
R120	ERDS2TJ561	560
R123	ERDS2TJ182	1.8K
R130	ERDS2TJ563	56K
R202	ERDS2TJ102	1K
R204	ERDS2TJ104	100K
R205	ERDS2TJ821	820
R211	ERDS2TJ122	1.2K
R214	ERDS2TJ474	470K
R301	ERDS2TJ333	33K
R305, 306	ERDS2TJ223	22K
R307	ERDS2TJ274	270K
R308	ERDS2TJ151	150
R309	ERDS2TJ153	15K
R310	ERDS2TJ102	1K
R311, 312	ERDS2TJ272	2.7K
R313, 314	ERDS2TJ104	100K
R317	ERDS2TJ103	10K
R401	ERDS2TJ331	330
R402	ERDS2TJ221	220
R403	ERDS2TJ181	180
R404	ERDS2TJ151	150
R405	ERDS2TJ122	1.2K
R406	ERDS2TJ561	560
R408	ERDS2TJ182	1.8K
R409	ERDS2TJ563	56K
R412	ERDS2TJ123	12K
R413	ERDS2TJ562	5.6K
R414	ERDS2TJ102	1K
R415	ERDS2TJ473	47K
R702	ERDS2TJ102	1K
R703	ERDS2TJ101	100
R704	ERDS2TJ102	1K
R705	ERDS2TJ101	100
R706	ERDS2TJ104	100K
R707	ERDS2TJ103	10K
R708	ERDS2TJ473	47K
R902	ERDS2TJ562	5.6K
R903	ERDS2TJ103	10K
R904	ERDS2TJ561	560
R905	ERDS2TJ102	1K
R910	ERDS2TJ473	47K
R911	ERDS2TJ102	1K
R912	ERDS2TJ101	100
R913	ERDS2TJ562	5.6K
R915	ERDS2TJ103	10K
R922	ERDS2TJ681	680
R924, 925	ERDS2TJ152	1.5K
R926	ERDS2TJ104	100K

● CAPACITORS

Ref. No.	Part No.	Value
C2	ECKD1H103ZF	0.01
C101	ECKD1H103ZF	0.01
C103	ECKD1H103ZF	0.01
C105	ECCD1H390KC	39P
C107	ECEA1HU010	1
C108	ECEA1CU100	10
C109	ECKD1H103ZF	0.01
C110	ECEA1CU100	10
C111	ECCD1H101K	100P
C112, 113	ECKD1H223ZF	0.022
C114	ECKD1H223ZF	0.022
C115	ECCD1H100KC	10P
C201	ECQM1H473JZ	0.047
C203	ECCD1H180KC	18P
C204	ECQP1471JZ	470P
C206	ECKD1H223ZF	0.022
C207	ECEA0JU101	100
C208	ECEA1EK4R7	4.7
C209	ECCD1H080CC	8P
C210	ECCD1H470K	47P
C211	ECFTD153KXL	0.015
C214	ECEA1AU101	100
C301	ECEA1CU100	10
C303	ECEA1CU101	100
C306	ECQP1471JZ	470P
C307	ECEA1HK010	1
C308	ECEA1HK3R3	3.3
C309	ECKD1H473ZF	0.047
C310	ECEA1HUR47	0.47
C313, 314	ECEA1HUR47	0.47
C315, 316	ECFTD273KXL	0.027
C401	ECEA1HU3R3	3.3
C402	ECEA1HU4R7	4.7
C701	ECKD2H102ZF	0.001
C702	ECEA1EU471	470
C703	ECEA1VU102	1000
C704	ECKD1H103ZF	0.01
C705	ECEA1CU471	470
C706	ECEA1CU222	2200
C707	ECKD1H103ZF	0.01
C708	ECEA1CU470	47
C902	ECKD1H223ZF	0.022
C903	ECEA25M4R7R	4.7
C904	ECKD1H103ZF	0.01
C908, 909	ECCD1H470K	47P
C910	ECCD1H100KC	10P
C911	ECEA0JU332	3300
C912, 913	ECKD1H103ZF	0.01
C914	ECEA0JU102	1000
C915	ECKD1H103ZF	0.01
C921	ECCD1H181K	180P
C922	RCBS1H102KBY	0.001

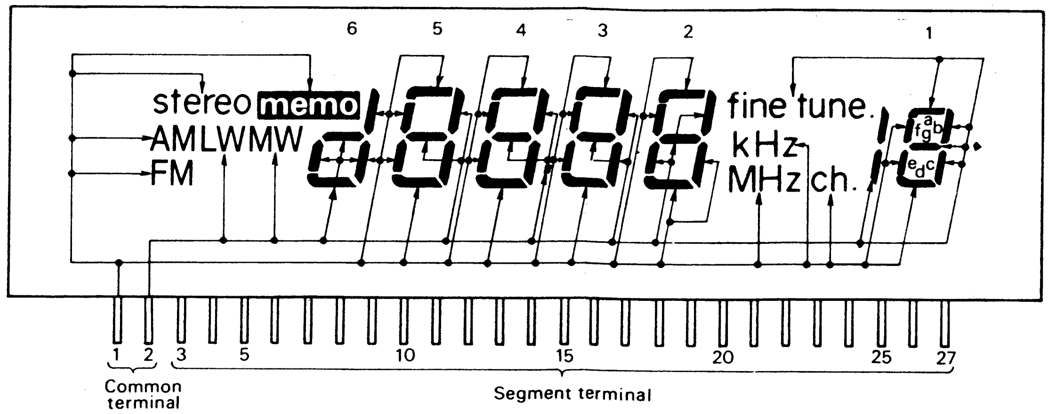
■ BLOCK DIAGRAM


FM ANT
FM FRONT END
FM signal
RF Amp
MIX
OSC
BUFFER
FM +B
CF101
FM IF
Q101.102
CF102
CF201
AM IFT
T201
FM OSC
TP101
TP102
FM MONO DISTORTION adj
T101.102
FM Det.Coil
+B1
Vcc
AFC
Vref
IC101
IC101 AM/FM IF
FM/AM IF
FM IF
FM Det
Muting Level Det.
Level Meter
Mute
AF
AF RF
MIX
AM OSC
AGC
AM Det.
+B AM
Q103
FM: ON
Q703 Q704 Q705
FM/AM Power supply selector
+B FM
+B AM
FM PLL stereo decoder
VOLTAGE REGULATOR
IC301
MPX
STEREO/MONO SELECTOR
PHASE DET
DC AMP
SCHMITT CIRCUIT
FORCIBLE MONO/VCO STOP
PHASE DET
DC AMP
VCO
38KHz F.F
19KHz < 90° F.F
19KHz < 0° F.F
LAMP DRIVE
IC301 FM MPX
VR302 MPX VCO adj.
TP302 MPX VCO adj.
Z301 L.P.F.
Z302 L.P.F.
Q403
Q404
J5 Lch
J5 Rch
OUTPUT (to Amplifier)
Q402 Muting Switch
Q104.105 Signal Det.
+B3
Memory back-up
AM ANT
AM signal
AM +B
L205
AM ANT COIL
CT202 AM-RF adj
AM/FM LOOP FILER
Q902.903
L204
AM OSC COIL
AM OSC
AM +B
LW/FM MONO
EO1
EO2
K3
K2
K1
K0
PB3
PB2
PB1
PB0
PC3
PC2
PC1
FM
AM
GND
VDD
SD
MUTE
FM
CE
REMOTE CONTROL
X2
X1
X901 Crystal OSC
IC901
IC901 PLL CONTROLLER
COM1
COM2
LCD1 ~ LCD4
LCD5 ~ LCD23
LCD
Q907 STEREO: ON
KEY MATRIX
UP S3
DOWN S2
AM S6
FM S5
FM MODE S7
CH5/13 S12
CH6/14 S13
CH7/15 S14
CH8/16 S15
CH1/9 S8
CH2/10 S9
CH3/11 S10
CH4/12 S11
MEMORY S4
Q401 LED Drive
Quartz lock
+B2
Signal ind.
S1 (POWER)
ON
STAND BY
PL1 BACK LAMP
14.5 +B1
11.0 +B2
5.6 +B3
Q701.702 D701~704
RECTIFIER /REGULATOR
J5 (from Amplifier) AC VOLTAGE
J5 (from Amplifier) AC VOLTAGE
J5 (from Amplifier) REMOTE
A

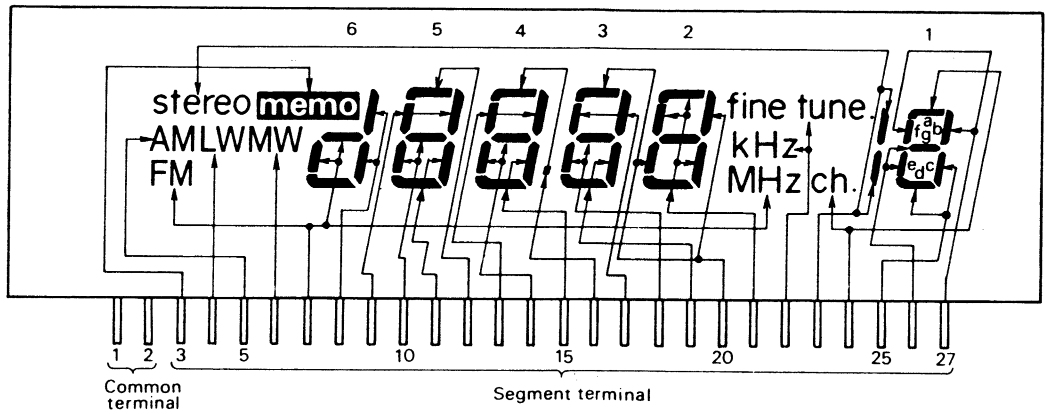

IC101
AM/FM IF
13
11
Q103
FM : ON
Q703
Q704
Q705
FM / AM Power supply selector
+B1
+B
FM
+B
AM
15
+B1
1
FM PLL stereo decoder
8
VOLTAGE REGULATOR
2
AF
MPX
3
IC301
STEREO/ MONO SELECTOR
AF
AF
PHASE DET
DC AMP
SCHMITT CIRCUIT
FORCIBLE MONO/ VCO STOP
12
PHASE DET.
DC AMP
VCO
38KHz F.F.
19KHz < 90° F.F.
19KHz < 0° F.F.
LAMP DRIVE
13
14
15
9
IC301
FM MPX
VR302
MPX VCO adj.
TP302
MPX VCO adj.
+B3
A
4
7
5
6
11
10
16
Z301
L.P.F.
Z302
L.P.F.
J5
L ch
J5
R ch
Q403
Q404
OUTPUT (to Amplifier)
Q402
Muting Switch
AM
+B
Q104, 105
Signal Det.
32
19
MUTE
FM
CE
13
+B1
Q401
LED Drive
Quartz lock
1
2
3
Signal ind.
+B2
REMOTE CONTROL
18
X2
16
X901 Crystal OSC
X1
15
S1 (POWER)
ON
STAND BY
PL1 BACK LAMP
14.5
+B1
ON
STAND BY
Q701.702
D701~704
RECTIFIER /REGULATOR
11.0
+B2
5.6
+B3
J5 (from Amplifier)
AC VOLTAGE
J5 (from Amplifier)
AC VOLTAGE
J5 (from Amplifier)
REMOTE

■ DESCRIPTION OF LCD PANEL

• COMMON


6
5
4
3
2
1
stereo
memo
AMLWMW
FM
fine tune.
kHz
MHz
ch.
a
f g b
e d c
1
2
3
5
10
15
20
25
27
Common terminal
Segment terminal

• SEGMENT

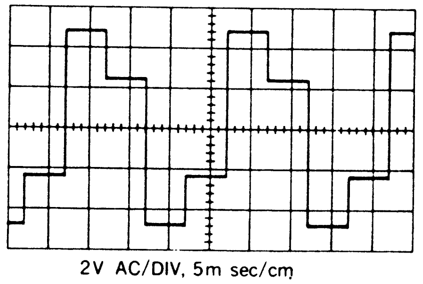

6
5
4
3
2
1
stereo
memo
AMLWMW
FM
fine tune.
kHz
MHz
ch.
a
f g b
e d c
1
2
3
5
10
15
20
25
27
Common terminal
Segment terminal

No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
COM1	COM1	—	MEMO	—	AM	—	FM, MHz	6b	5f	5e	5d	5a	4f	4e	4d
COM2	—	COM2	—	LW	—	MW	6deg	6c	5b	5g	5c	—	4b	4g	4c

No.	16	17	18	19	20	21	22	23	24	25	26	27
COM1	4a	3f	3e	3d	3a	2acdf	kHz	stereo	ch	1d	1e	1f
COM2	▰	3b	3g	3c	2be	2g	fine tune	⁚	1a	1c	1g	1b

< **Segment ON** >

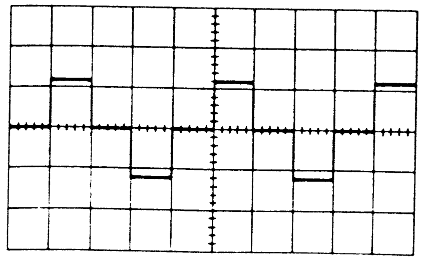
Pin ① or ② of LCD and each segment terminal.



2V AC/DIV, 5m sec/cm

< **Segment OFF** >

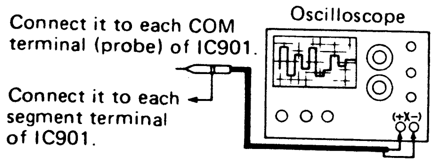
Pin ① or ② of LCD and each segment terminal.

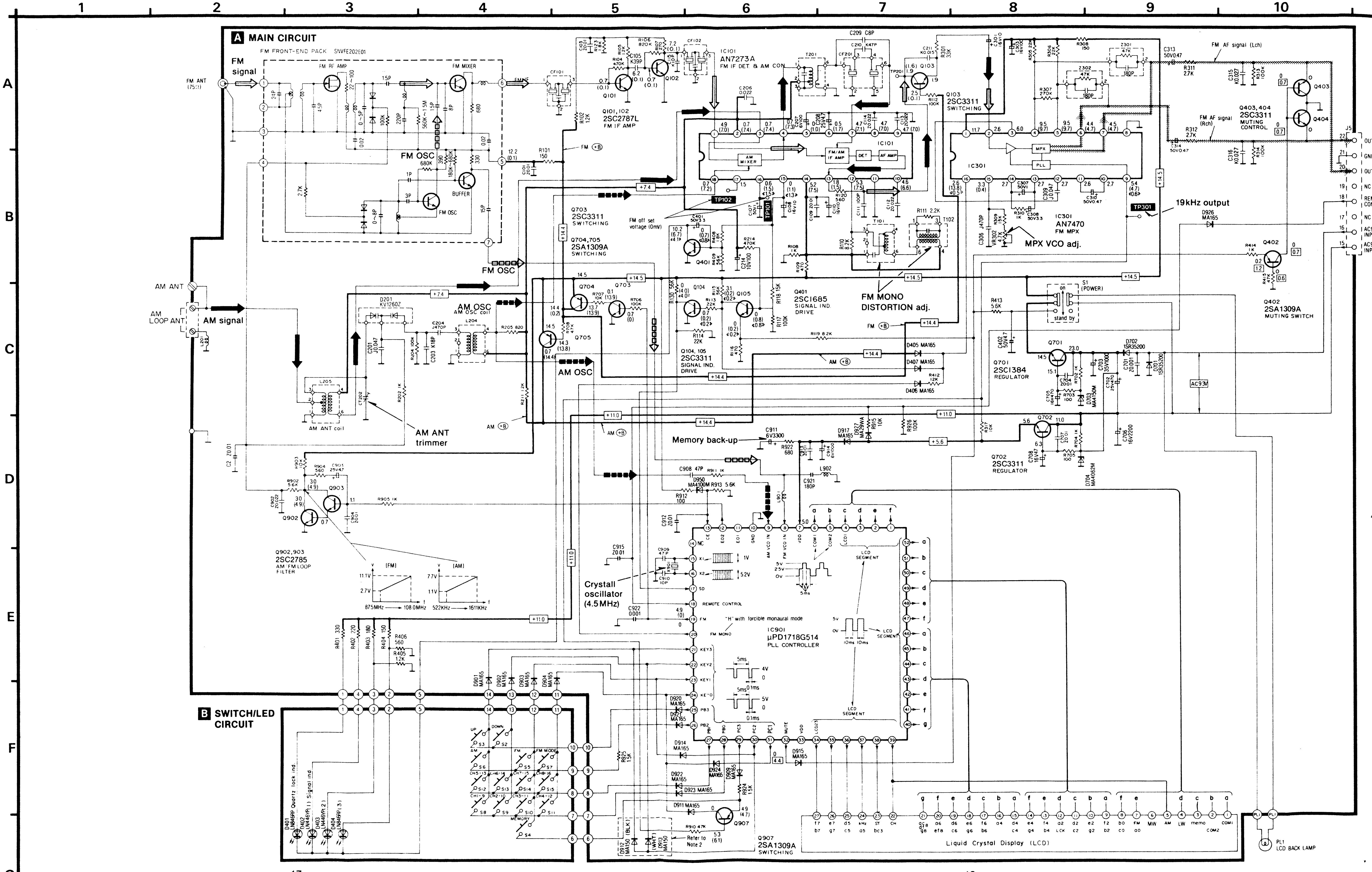


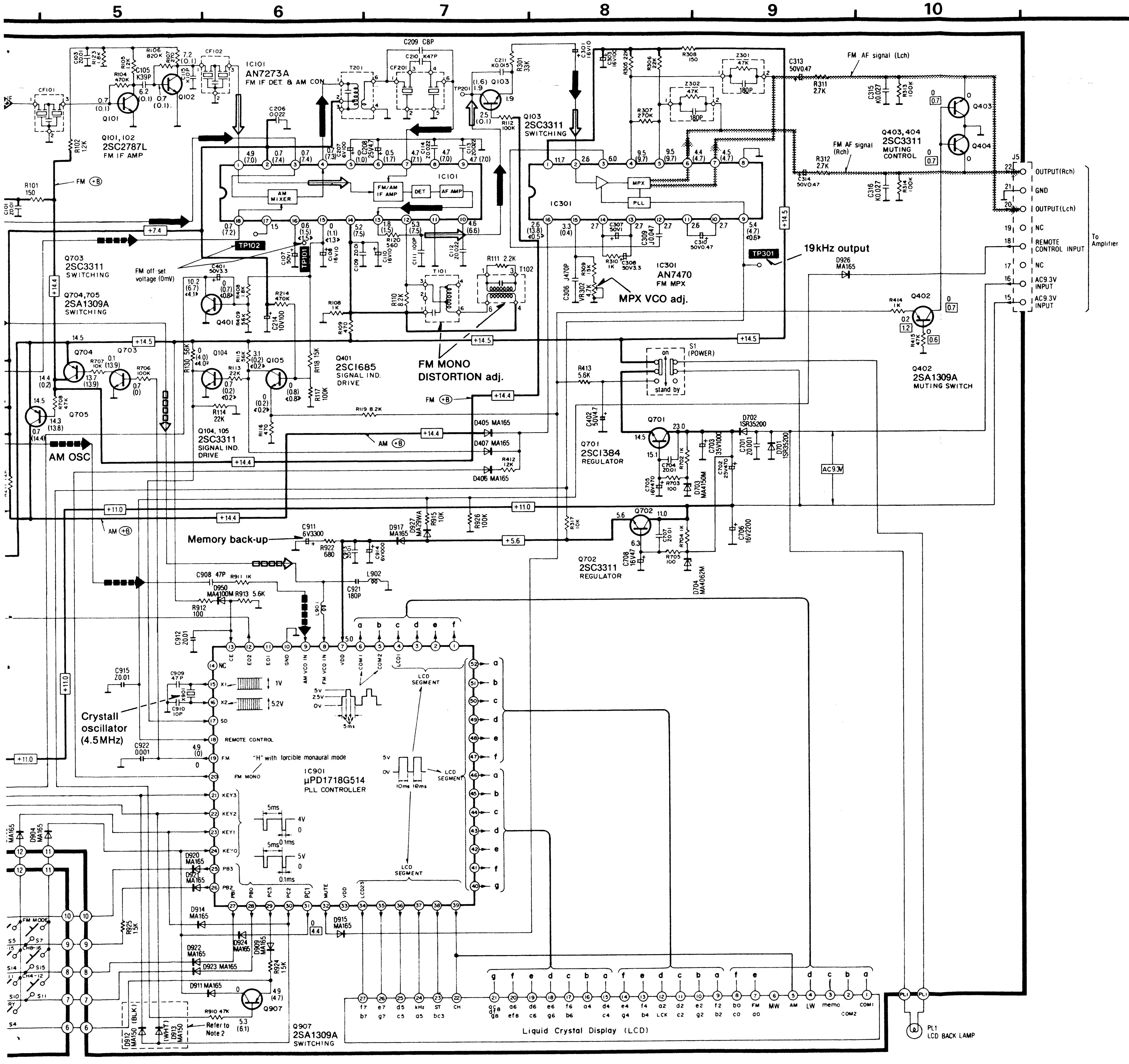
2V AC/DIV, 5m sec/cm

• Each segment waveform measuring method

Note: Potential difference from COM terminal waveform is measured for each segment output waveform. So, do not connect the earth to other equipment on the oscilloscope side. If the earth is connected, IC901 will break down.


Oscilloscope
Connect it to each COM terminal (probe) of IC901.
Connect it to each segment terminal of IC901.
(+X-)


A MAIN CIRCUIT
B SWITCH/LED CIRCUIT
FM signal
FM ANT (75Ω)
FM FRONT-END PACK SNVFE202E01
FM RF AMP
FM MIXER
FM OSC
BUFFER
FM IF
CF101
Q101
Q102
Q101, 102 2SC2787L FM IF AMP
IC101 AN7273A FM IF DET & AM CON
AM MIXER
FM/AM IF AMP
DET
AF AMP
T201
CF201
C209 C8P
Q103
Q103 2SC3311 SWITCHING
TP201
TP101
TP102
FM off set voltage (0mV)
Q401
Q401 2SC1685 SIGNAL IND. DRIVE
Q104
Q105
Q104, 105 2SC3311 SIGNAL IND. DRIVE
T101
T102
FM MONO DISTORTION adj.
IC301
IC301 AN7470 FM MPX
MPX
PLL
VR302
MPX VCO adj.
TP301
19kHz output
FM AF signal (Lch)
FM AF signal (Rch)
Q403
Q404
Q403, 404 2SC3311 MUTING CONTROL
Q402
Q402 2SA1309A MUTING SWITCH
J5
OUT
GND
OUT
NC
REM CON
NC
AC9V INP
AC9V INP
S1 (POWER)
on
stand by
Q701
Q701 2SC1384 REGULATOR
Q702
Q702 2SC3311 REGULATOR
D702 1SR35200
D701 1SR35200
D703 MA4150M
D704 MA4062M
AC9V
Q703
Q703 2SC3311 SWITCHING
Q704
Q705
Q704, 705 2SA1309A SWITCHING
AM ANT
AM LOOP ANT
AM signal
AM OSC
AM OSC coil
D201 KV1260Z
L204
L205
AM ANT coil
AM ANT trimmer
CT202
Q902
Q903
Q902, 903 2SC2785 AM/FM LOOP FILTER
[FM]
[AM]
11.1V
2.7V
87.5MHz
108.0MHz
7.7V
1.1V
522KHz
1611KHz
Memory back-up
C911 6V3300
Crystall oscillator (4.5MHz)
IC901 µPD1718G514 PLL CONTROLLER
"H" with forcible monaural mode
REMOTE CONTROL
FM MONO
KEY3
KEY2
KEY1
KEY0
LCD SEGMENT
5ms
10ms
0.1ms
Q907
Q907 2SA1309A SWITCHING
Refer to Note 2
D912 MA150 (BLK)
D910 MA150 (WHT)
UP
DOWN
FM
FM MODE
MEMORY
D401 LN46RP Quartz lock ind.
D402 LN46RP(1) Signal ind.
D403 LN46RP(2)
D404 LN46RP(3)
Liquid Crystal Display (LCD)
PL1 LCD BACK LAMP
+14.4
+14.5
+11.0
+7.4
+5.6
FM ⊕B
AM ⊕B
1
2
3
4
5
6
7
8
9
10
A
B
C
D
E
F
G


5
6
7
8
9
10
IC101
AN7273A
FM IF DET. & AM CON.
Q101, 102
2SC2787L
FM IF AMP
CF101
CF102
T201
T101
T102
Q103
2SC3311
SWITCHING
AM MIXER
FM/AM IF AMP
DET
AF AMP
IC301
AN7470
FM MPX
MPX
PLL
MPX VCO adj.
19kHz output
TP101
TP102
TP201
TP301
FM AF signal (Lch)
FM AF signal (Rch)
Q403, 404
2SC3311
MUTING CONTROL
Q402
2SA1309A
MUTING SWITCH
OUTPUT(Rch)
GND
OUTPUT(Lch)
NC
REMOTE CONTROL INPUT
AC9.3V INPUT
To Amplifier
Q703
2SC3311
SWITCHING
Q704,705
2SA1309A
SWITCHING
FM off set voltage (0mV)
Q401
Q104, 105
2SC3311
SIGNAL IND. DRIVE
Q401
2SC1685
SIGNAL IND. DRIVE
FM MONO DISTORTION adj.
AM OSC
S1 (POWER)
Q701
2SC1384
REGULATOR
Q702
2SC3311
REGULATOR
Memory back-up
Crystall oscillator (4.5MHz)
IC901
μPD1718G514
PLL CONTROLLER
LCD SEGMENT
"H" with forcible monaural mode
FM MONO
Q907
2SA1309A
SWITCHING
Refer to Note 2
Liquid Crystal Display (LCD)
PL1
LCD BACK LAMP

■SCHEMATIC DIAGRAM

(This schematic diagram may be modified at any time with the development of new technology.)

Note 1:

- **S1** : Power switch in "on" position.
- **S2** : Tuning (down) switch.
  [down: tuning to lower frequency]
- **S3** : Tuning (up) switch.
  [up: tuning to higher frequency]
- **S4** : Memory set switch. (manual ↔ auto memory)
- **S5** : FM select switch.
- **S6** : AM select switch.
- **S7** : FM mode switch. (stereo ↔ mono)
- **S8～S15** : Preset tuning switch.
  - *With it momentarily pushed (less than 0.4 sec.) and released, the 1～8 CH are received.
  - *With it continuously pushed (0.4 sec. or more) and released, the 9～16 CH are received.
- Indicated voltage values are the standard values for the unit measured by the DC electronic circuit tester (high-impedance) with the chassis taken as standard. Therefore, there may exist some errors in the voltage values, depending on the internal impedance of the DC circuit tester.
  All voltage values shown in circuitry are DC voltage in FM signal (no signal) reception modes.
  - *Figures in ◀ ▶ stand for DC voltage in FM stereo signal reception mode.
  - *Figures in ( ) stand for DC voltage in AM signal reception mode.
  - *Figures in ▭ stand for muting mode.

────	Positive voltage lines	░░░▷	AF signal lines
□□□□▷	FM OSC	⇨	FM signal
■■■■▶	AM OSC	➡	AM signal

Part No.	Original Part No.	Supply Part No.
IC301 D912, 913	AN7470 MA150	SVIUPC1161C3 MA162A

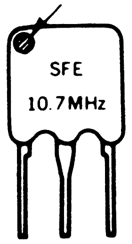
Note 2:

- **Use of ceramic filters in pairs**

The ceramic filters (CF101, CF102) for FM-IF circuit are available in three versions. For this circuit, be sure to use the ceramics of the same version in a pair.

At repairing and replacement, pay close attention to the diodes (D912, D913) for use as different diodes must be used depending on each version of the ceramic filters.

Color marking
(Red, Black or White)



VERSION (Color)	D912	D913	CENTER FREQUENCY
Black	○	×	10.65MHz
Red	×	×	10.70MHz
White	×	○	10.75MHz

Note: ○ mark: Diode is used.
× mark: Diode is not used.

＊Caution!

IC and LSI are sensitive to static electricity.
Secondary trouble can be prevented by taking care during repair.

- Cover the parts boxes made of plastics with aluminum foil.
- Ground the soldering iron.
- Put a conductive mat on the work table.
- Do not touch the legs of IC or LSI with the fingers directly.

■ REPLACEMENT PARTS LIST

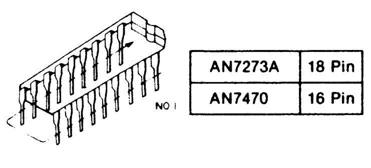
Notes:
- Part numbers are indicated on most mechanical parts. Please use this part number for parts order.
- The parenthesized numbers in the column of description stand for the quantity per set.

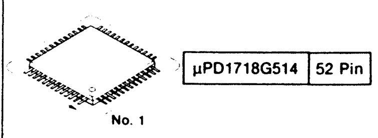
Ref. No.	Part No.	Description
INTEGRATED CIRCUITS		
IC101	AN7273B	Integrated Circuit
IC301	SVIUPC1161C3	Integrated Circuit
IC901	UPD1718G514	Integrated Circuit
TRANSISTORS		
Q101, 102	2SC2787L	Transistor
Q103～105, 403, 404, 703	2SC3311－Q	Transistor
Q401	2SC1685－QNC	Transistor
Q402, 704, 705, 907	2SA1309Q	Transistor
Q902, 903	2SC2785F	Transistor
Q701	2SC1384A－R	Transistor
Q702	2SC3311－Q	Transistor
DIODES		
D201	KV1260Z	Diode
D401	LN846RP	L.E.D.
D402～404	LN446YP	L.E.D.
D405～407, 901～904, 909, 911, 914, 915, 917, 920～924, 926	MA165	Diode
D701, 702	1SR35200	Rectifier
D703	MA4150M	Diode
D704	MA4062M	Diode
D912, 913	MA162A	Diode
D927	MA29WA	Diode
D950	MA4100M	Diode
COILS		
L201, 901	ELEPKR22MA	Choke, 0.22μH
L204	SLO2B7－M	AM OSC
L205	SLA2B1－1M	AM Antenna
L902	ELEPK1R2MA	Choke, 1.2μH
TRANSFORMERS		
T101	SLI4B511－Z	FM IFT
T102	SLI4B513－Z	FM IFT
T201	SLI2B101－M	AM IFT

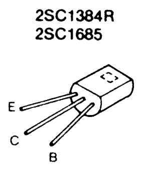
Ref. No.	Part No.	Description
CERAMIC FILTERS		
CF101, 102	SVFE107MS2－A	FM, 10.7MHz (Red)
	SVFE107MS2－D	FM, 10.65MHz (Black)
	SVFE107MS2－E	FM, 10.75MHz (White)
CF201	SVFSFZ450F7L	AM, 450kHz
CRYSTAL		
X901	SVQ49U452－T	4.5MHz Counter OSC
COMPONENT COMBINATIONS		
Z301, 302	EXRP181K473C	180pF, 47kΩ
VARIABLE RESISTOR		
VR302	QVNB3A00B472	FM MPX VCD Adj.
VARIABLE CAPACITOR		
CT202	ECRHA010A41	AM ANT Trimmer
LIQUID CRYSTAL DISPLAY		
LCD	SALHLC9225－5	LCD
FM FRONT END		
	SNVFE202E01	FM Front End Pack
LAMP		
PL1	XAMS15S150	Lamp
SWITCHES		
S1	SSH1196	Power Switch
S2～15	SSG13	Preset, Band Selector, FM Mode, Tuning, Memory

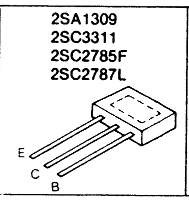
Ref. No.	Part No.	Description
CABINET and CHASSIS PARTS		
1	SGYTS75－KP	Front Panel Ass'y (1)
(1-1	(SDU293B	Transparent Plate (1)
2	SBC814－1	Preset Button (1)
3	SBCTS75－KM	Selector Button Ass'y (1)
4	SBC666－3	Power Button (1)
5	SBC815－1	Tuning Button (1)
6	SHR415	Nylon Pin (1)
7	SDU296A	Filter (1)
8	SMP409	Lamp Case (1)
9	SHE170－1	Spacer (2)
10	SKC1930K99	Cabinet (1)
11	SJF8401N	Terminal Board (1)
12	SUS803	Spring, Ground (1)
13	SGPTS75－KP	Rear Panel Ass'y (1)
(13-1	(SKL297－1	Foot (4)
14	SHR9798	L.E.D. Case (1)
15	SWK1659－1	Cord (1)
SCREWS		
N1	XTB3＋8G	Tapping, ⊕3×8 (1)
N2	XTBS3＋12F1	Tapping, ⊕3×12 (2)
N3	XTBS3＋8JFZ1	Tapping, ⊕3×8 (8)
N4	XTWS3＋10Q	Tapping, ⊕3×10 (1)
ACCESSORIES		
A1	SSA269M	FM Antenna Cord (1)
A2	SPB1139	Loop Antenna (1)
A3	SPB1141－2	Bracket (1)
A4	SQX54051	Instruction Book (1)
PACKING PARTS		
P1	SPG5717	Carton Box (1)
P2	SPS4717	Pad, Left Side (1)
P3	SPS4718	Pad, Right Side (1)
P4	SPS4755	Pad (1)
P5	SPP711	Polyethylene Bag (1)

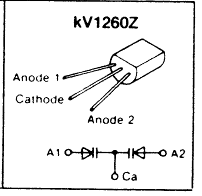
• Terminal Guide of IC's, Transistors and Diodes

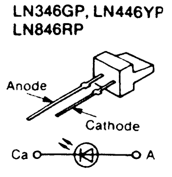

NO 1
AN7273A | 18 Pin
AN7470 | 16 Pin

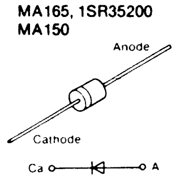

μPD1718G514 | 52 Pin
No. 1

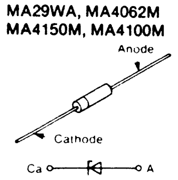

2SC1384R
2SC1685
E
C
B


2SA1309
2SC3311
2SC2785F
2SC2787L
E
C
B

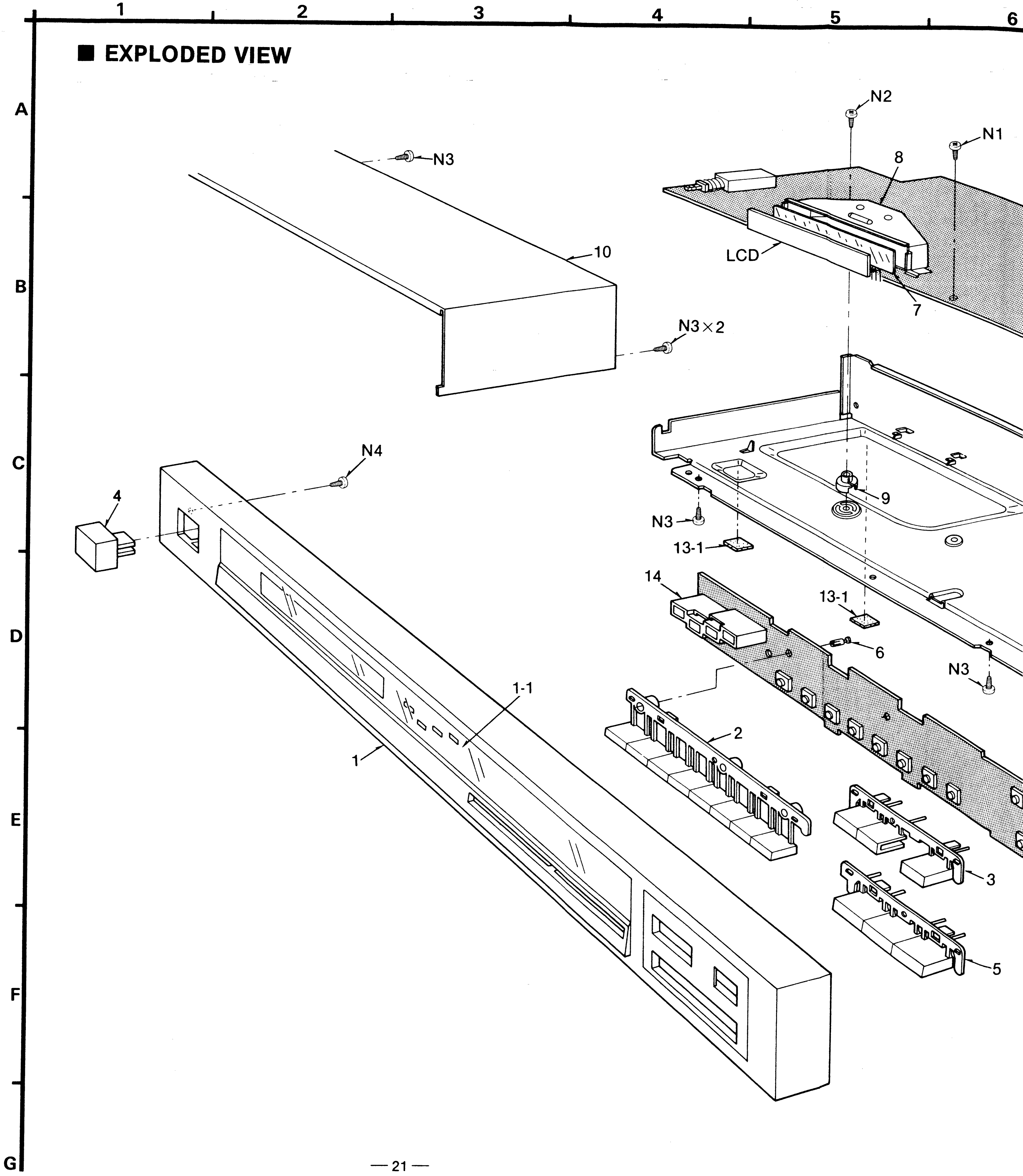

kV1260Z
Anode 1
Cathode
Anode 2
A1
A2
Ca


LN346GP, LN446YP
LN846RP
Anode
Cathode
Ca
A


MA165, 1SR35200
MA150
Anode
Cathode
Ca
A


MA29WA, MA4062M
MA4150M, MA4100M
Anode
Cathode
Ca
A

■ EXPLODED VIEW


1
2
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A
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C
D
E
F
G
N2
N1
N3
8
10
LCD
7
N3×2
N4
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N3
13-1
14
13-1
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N3
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d	(1)
s'y	(1)
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	(1)
:8	(1)
:12	(2)
:8	(8)
:10	(1)
Cord	(1)
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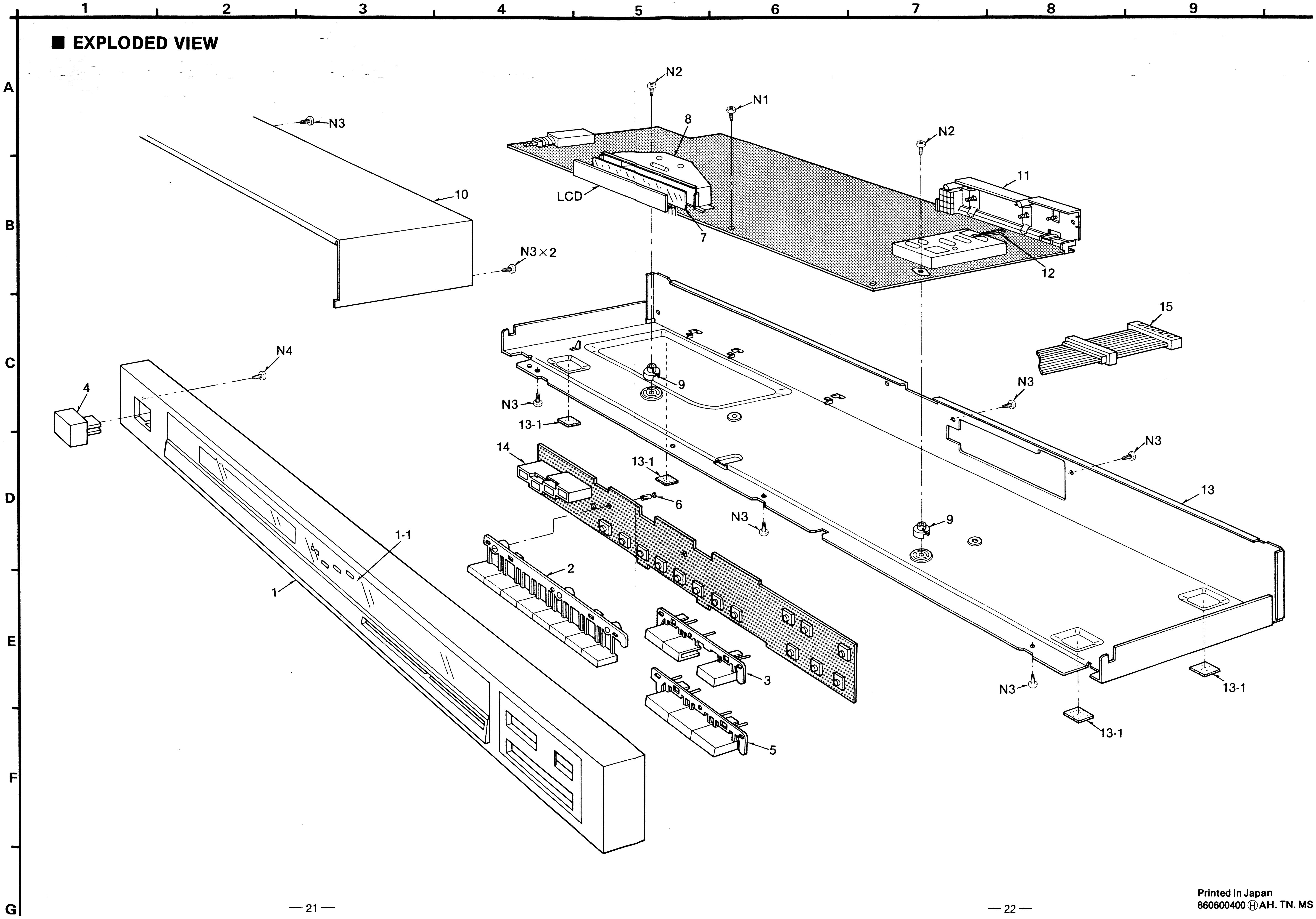
■ EXPLODED VIEW


1
2
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9
A
B
C
D
E
F
G
N2
N1
N2
N3
8
LCD
7
10
11
12
N3×2
15
N4
4
N3
9
13-1
N3
14
13-1
N3
6
N3
9
13
1-1
2
1
3
5
N3
13-1
13-1

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